Infinite Energy

Cold Fusion and New Energy Technology

Published by Cold Fusion Technology

Vol. I, No.2 1995

Alchemy Nightmare: Skeptic Finds Heavy Element Transmutation in Cold Fusion Experiment!

Magnetic Resonance Amplifier Tests Positive for Excess Power?

Major Oil Company Reveals Secret Positive Cold Fusion Experiment in 1989

Cold Fusion Goes Commercial!

Dr. James Patterson and Jim Reding of Clean Energy Technologies, Inc. Aim to Help Clean Up the World.

Energy Bombshell from Moldova:
Water Fuel Device Conquers the Marketplace

CETI

U.S. $5.95

Canada $7.95

New Energy Times Archive

Experience the excitement of scientific history in the making...

Witness key scientific and commercial presentations at the

Fifth International Conference on Cold Fusion (ICCF5), Monte Carlo, Monaco,

At the elegant Hotel Loews, 9-13 April 1995.

ORDER your set of VIDEO TAPES of ICCF5 today! **Available in Mid-July 1995.**

Cold Fusion Technology presents some of the most significant presentations in a set of four (4) video tapes (approximately 8-hours total view time). The scientific slides presented by the speakers are clearly visible. Tape format is standard VHS (with U.S. NTSC recording format—may be converted by purchaser to PAL or other formats). ***Tapes are Copyright 1995 Cold Fusion Technology.*** **PRICE: only US $210 for U.S. and Canada; only US $230 for other foreign. Price includes first-class air mail. ADDED VALUE:** ***A full set of ICCF5 scientific abstracts, as well as an index of participants is included with each tape set.***

Order today! Send check or money order (US funds) to:

Cold Fusion Technology, P.O. Box 2816, Concord, New Hampshire 03302-2816 USA.

Or, provide credit card information (Master Card, VISA, AMEX).FAX: 603-224-5975

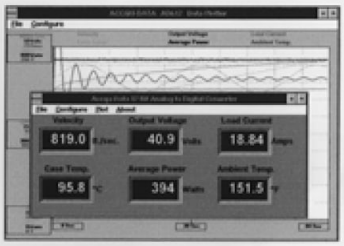
PC Printer Port Based Instrumentation and Data Acquisition

Monitor and record temperatures and other parameters using any PC

Simple installation
No external power required

AD612	6 Channel, 12 Bit, voltage input Data Acquisition module (Includes software for display, plotting, and logging to disk)	$99.95
TSC5-T	Thermocouple Signal Conditioner for use with AD612. Accepts 5 Type T Thermocouple inputs on channels 1-5 and displays ambient temperature on channel 0.	$79.95
TP4-T	4" Thermocouple probe (Type T)	$29.00 (5 for $115.00)

Custom software available



ACCQU-DATA

297 Route 72 West Suite C-178 Manahawkin, NJ 08050-2890
FAX : (609) 597-1221 BBS : (908) 774-7499

FOR BROCHURE or TO ORDER : (800) 341-5590 OUTSIDE US: (970) 872-8355

New Energy Times Archive

Infinite Energy

Cold Fusion and New Energy Technology

Volume 1, No.2, May/June 1995

Publisher and Editor-in-Chief
Eugene F. Mallove, Sc.D.

Associate Editor
Hal Fox
(Fusion Information Center, Salt Lake City, Utah)

Contributing Editors
Lawrence P.G. Forsley (Virginia)
Jed Rothwell (Georgia)
Christopher Tinsley (UK)

Assistant Editor
Stuart Norwood

Art and Graphics
Rhonda Eklund
Pamela J. Veenstra
Town and Country Reprographics, Inc.

Scientific Advisory Board
Dr. Robert W. Bass
Thousand Oaks, California
Dr. John O'M. Bockris
Texas A&M University
Dr. Dennis Cravens
Vernon Regional College, Vernon, TX
Dr. Peter Glück
Institute of Isotopic and Molecular Technology
Romania
Dr. Edmund Storms
ENECO

INFINITE ENERGY Magazine *(ISSN 1081-6372) is published six times a year by Cold Fusion Technology, P.O. Box 2816, Concord, New Hampshire 03302-2816. Subscription price: $29.95 U.S. and Canada, $49.95 other foreign. POSTMASTER: Send address changes to INFINITE ENERGY, P.O. Box 2816, Concord, NH 03302-2816.*

INFINITE ENERGY Magazine
P.O. Box 2816
Concord, NH 03302-2816
Phone: (603) 228-4516
Fax: (603) 224-5975
E-Mail:
INTERNET:76570.2270@compuserve.com

PRINTED IN THE USA

Copyright © by Cold Fusion Technology.
All rights reserved.

Table of Contents

Volume 1, Issue #2 May/June 1995

Breaking Through, Editorial 3
Letters 5

The Fifth International Conference on Cold Fusion (ICCF5)—Highlights
Jed Rothwell 7

ICCF5 Participating Organizations
Akira Kawasaki 17

Flowing Electrolyte Calorimetry
Dennis Cravens 18

Comments on Dr. Cravens' Work
Jed Rothwell 22

A Development Approach for Cold Fusion
Bruce Klein 27

Alchemy Nightmare: Skeptic Finds Heavy Element Transmutation in Experiment
Eugene Mallove 30

Energy Bombshell from Moldova—**SPECIAL REPORT**

Water Fuel Device Conquers the Marketplace
Christopher P. Tinsley 33

On One of the Energy Generation Mechanisms in Unitary Quantum Mechanics
Lev G. Sapogin 38

Magnetic Resonance Amplifier Controversy
Norman Wootan, Hal Puthoff 40

COMMENTARY

Cold Fusion in 2001 and Beyond: Lessons from High Tech
Robert W. Horst 44

Proposal for Designing a Cold Fusion Reactor and its Commercialization
Lev G. Sapogin 47

PATENT FILE
The MIT Cold Fusion Patent #5,411,654

EXPERIMENTER'S CORNER
Self-Heated Pd Wire in H_2/D_2: Nuclear Effects?
M. Srinivasan et al 50

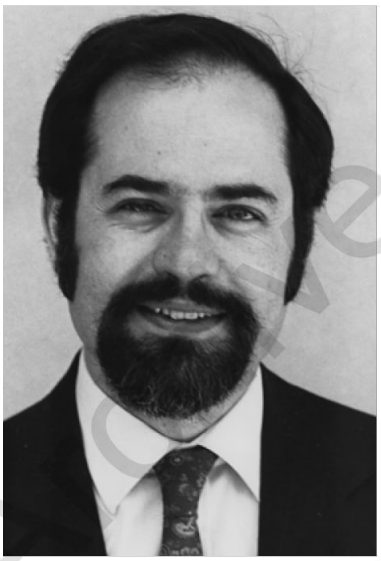
Briefs 52
Calendar 46
Washington Watch 54

COVER: Dr. James Patterson and Jim Reding of Clean Energy Technologies; Inset: Dr. Peter Glück, Dr. Lev Sapogin, and Dr. Yu. Potapov with Water Fuel Heater in Moldova

New Energy Times Archive

By Eugene F. Mallove, Sc.D.

Cold Fusion Goes Commercial...



We knew all along it would happen.....

"cold fusion" would begin to be commercialized long before science fully came to grips with what the mysterious and extremely potent excess heat-generating process really is.

Remarkably, cold fusion is being commercialized even in the face of continued wide-spread, but obviously misguided skepticism that the phenomenon even exists! As former Los Alamos National Laboratory scientist Dr. Edmund Storms, now with Salt Lake City-based ENECO, has suggested, "We can thank the skeptics for allowing some of us the chance to become very rich." Clearly, if the U.S. Department of Energy evaluation of cold fusion in 1989 had been even 10% objective, and if threatened institutions had been open to the new discovery, in 1995 there would be precious little room in the field for small companies and entrepreneurs.

As it stands now, "cold fusion" and allied "new energy" technologies, in which energy appears to materialize perhaps literally from the vacuum quantum fluctuations of space or from subtle mass conversion to energy — are possibly the greatest commercial opportunities of this century. It is the quintessential entrepreneurial field, in which those "in the know" have an opportunity to reap vast rewards in a tidal wave of business activity. The entire energy infrastructure of advanced industrial civilization is at the brink of radical reconstruction as early-stage and prototype cold fusion systems emerge with great vigor.

Our *Infinite Energy* cover highlights the work of Dr. James Patterson and his robust cold fusion cell, which has the honor of having been granted the first U.S. Patent for a cold fusion apparatus. It was a smash hit at the Fifth International Conference on Cold Fusion (ICCF5) at Monte Carlo, Monaco last April. Participants were invited to test it themselves—and they did. The cell bubbled with excess energy throughout the conference.

Clean Energy Technologies, Inc. (CETI) of Dallas, Texas intends to scale up this highly reproducible electrochemical cold fusion system, which has already proved that output/input power ratios of 10:1 (i.e. 1,000 %) are achievable. The CEO of CETI, Jim Reding (incidentally, the grandson of Dr. Patterson), has told *IE* that his company is working with other individuals and companies to produce high power units in the kilowatt range as soon as possible. It seems to us at *IE* that kilowatt-level heat production with this process is a distinct possibility within the next six-months or so.

There may even be a lightweight cold fusion-powered car within the next two years! Many readers may have heard of the spritely solar-powered cars that have traversed the U.S. and Australia in "Tour de Sol" races in recent years. Well, at least one cold fusion pioneer has his eyes on driving such a light-weight vehicle —with solar panels replaced by a one-horsepower cold fusion engine—clear across the U.S. Maybe he will park it near the U.S. Patent Office, which is still blocking hundreds of U.S. patent applications for cold fusion. (Patterson's was granted by what amounts to a bureaucratic slip-up by the obstructing authorities!)

It is most remarkable that the Patterson Power Cell works with *ordinary* water, *not* the heavy water of the original Pons and Fleischmann cell. The potential of this ordinary water technology has been a very hot prospect ever since Dr. Randall Mills in Pennsylvania announced his nickel-based ordinary water "hydrocatalysis" process back in 1991. Technological setbacks may have temporarily stalled the work at Hydrocatalysis Power Corporation and at nearby Thermacore in Pennsylvania, but it is very much alive in Texas and at other labs and corporations known to be working with CETI.

At ICCF5, electrical engineer Bruce Klein with Bechtel Corp gave the attendees his perspective of how large corporations could begin to become involved in the field. For their own sake, one hopes that some of them will heed Klein's advice, which we reprint here in full. Dr. Robert Horst of Tandem Computers also puts forward his personal ideas about market strategies for cold fusion companies.

Now for an incredible commercial bombshell— a water-fuel device that did not originate from the mainline cold fusion field at all, but which is very definitely penetrating the marketplace already in eastern Europe. We have learned that in a former region of the Soviet Union, now the country of Moldova (known also as Moldavia), the VIZOR Corporation in Kishinev has already sold thousands of heating units to homes and industries! These work on the cavitation principle in ordinary water, very reminiscent of the Hydrosonic Pump of Hydrodynamics, Inc. of Rome, Georgia in the US, only they are apparently *much* more effective in generating excess thermal energy.

The Hydrosonic Pump of James Griggs may produce 10% to 50% excess power as steam or hot water—in the kilowatt range, from a metal cylinder rotating in ordinary water in a confined chamber. This is remarkable enough, and has already been confirmed to have reduced the electric heating bills in some US installations. But Dr. Yuri S. Potapov's devices input several kilowatts of electricity into a centrifugal water pump that feeds the device and gets out reportedly 400% to 1,000% excess

New Energy Times Archive

power in hot water! Laboratory reports from other CIS states appear to confirm these claims. But what is most important is that hundreds upon hundreds of satisfied customers have *ratified the technology in the marketplace!* Who would buy a device that potentially could *increase* their electric hot water heating bill by 100% if the conventional centrifugal pump were say only 50% efficient (a common efficiency for such pumps)? The answer is simple: nobody! Russians and Moldovans are no fools. They know when their water heating and space heating bills have been cut in half or less— as VIZOR's customers regularly report. That would mean these devices *have* to be in the range of at least 400% "over-unity." Of course, this is such a provocative preliminary conclusion, it simply *has* to be tested in laboratories in the US and elsewhere before it can be fully accepted. That is precisely what will soon happen. Please stay tuned!

IE contributing editor Chris Tinsley of the UK and *IE* scientific advisor, chemical engineer Dr. Peter Glück of Romania, traveled to Kishinev to see what was going on at VIZOR; they file their report in this issue. What they found was most astonishing: an obviously robust commercial enterprise, producing a variety of heating units that can heat entire large buildings. The essence of these units is a fluid vortex chamber that apparently produces intense cavitation between fluid layers. If the Griggs Hydrosonic Pump and the E-Quest Sciences ultrasonic reactor are taken as confirmed evidence that remarkable energy-producing effects are at work in cavitation systems, then it is a small step to imagine that Potapov's machines work too. The quantum leap of VIZOR's machines is their spectacularly greater efficiency in their present embodiment.

People associated with the Russian space program have become convinced that the Potapov technology is real and revolutionary. Moreover, theoretical physicist Dr. Lev G. Sapogin of MADI Technical University in Moscow proposes a theory to explain the Potapov device, as well as more conventional "cold fusion" processes. Readers are invited to explore his challenging theory in this issue of *IE*.. Preliminary testing revealed no neutron or gamma radiation emanating from tests of the Potapov devices. Certainly no mere chemical ash commensurate with the astonishing excess power could be found. What does that leave? Zero Point Energy? Subtle mass conversion to energy in heretofore unknown ways, or some subtle radiationless nuclear reaction still undetected? Whatever the case, profound shocks are certain to be coming to the world of physics—ordinary "conventional" cold fusion was enough to do that already. Electric energy production in self-sustaining devices may not be far behind—or may already have been achieved, as Dr. Potapov suggests. But these earthquakes from cavitation devices that may rock physical theory to its foundations are no less portentous than the shock to the world's energy economy that is about to occur. Welcome, indeed, to the Water Fuel/"Free Energy" age! Cold fusion, at long last, has gone commercial.

∞

Institute for New Energy

is an international organization to promote new and renewable enegy sources. Its monthly newsletter is

New Energy News,

reporting worldwide on all facets of new and enhanced energy. Memberships in INE are $35 per year for individual, $60 for corporations & libraries, and includes 12 issues of *NEN*

Fusion Facts,

a monthly scientific newsletter covering worldwide research in the cold fusion phenomena.
Subscriptions are $300 per 12 issues.

Fusion Information Center
P.O. Box 58639
Salt Lake City, UT 84158

Also available, *Cold Fusion Impact in the Enhanced Energy Age*, a book about the near future of the world energy situation. Phone for information: 801-583-6232

INVENTORS

Are you looking for a proven team who will help protect and develop your cold fusion invention?

MANUFACTURERS

Do you need information on cold fusion inventions and processes that are available for commercialization?

Contact **ENECO**

We are an intellectual property clearinghouse serving the interests of both cold fusion inventors and commercial developers throughout the world. Our staff is actively pursuing allowance of U.S. and international patents in most areas of cold fusion effects, including the original, pioneering work of Pons and Fleischmann.

Call us to discuss our development and licensing programs: Phone: (801) 583-2000, Fx: (801) 583-6245

ENECO

391-B Chipeta Way
Salt lake City, Utah 84108

New Energy Times Archive

Letters to the Editor:

Congratulations on putting together a very interesting magazine and presenting some detailed information that is hard to find any where else. I am very pleased with the first volume of *I.E.* , to say the least. Thanks for the great job of compiling this information and getting it "out the door" for folks like me to read.

I was very interested in the article on page 48 of your March-April issue called "The Dream Energy." Is there any way I could get a copy of the diagram of the motor and how the magnets were laid out? Even if someone could draw a rough sketch on paper and send it to me, I would greatly appreciate it. I would be glad to pay for any cost involved. Or if the video tape of the Fuji Television Network program is available from I.E. or from Bertil Werjefelt of PolyTech(USA) in Hawaii, perhaps I could buy a copy of it.

Lee M. Rey
Spokane, Washington

Indeed, the Japanese and Werjefelt-PolyTech (USA) work is detailed in the tape set that is available from Cold Fusion Technology. —*Editor*

Frontier Perspectives

The history of science has shown repeatedly that novel scientific discoveries now believed to be true were typically disregarded in their time. Unfortunately, the present is no exception; frontier scientists who dare to work at the edges of science face extraordinary obstacles. The Center for Frontier Sciences was establishes in 1987 to coordinate globally information exchange, networking, and education on frontier issues of science, medicine, and technology. The Center helps engender greater openness to novel scientific claims in several areas, including bioelectromagnetics, the mind-matter interrelationship, complementary medicine, and new energy technology.

If you wish to receive Frontier Perspectives regularly, 2 issues per year, as well as notification of events hosted by the Center, the annual subscription fee is $30.00.

Center for Frontier Sciences
Temple University,
Ritter Hall 003-00
13th & Montgomery Streets
Philadelphia, PA 19122 USA
Telephone: (215)-204-8487

I received Vol.1 of *Infinite Energy* today and literally read every word, cover to cover. It's extremely interesting and high quality. Keep up the good work!

David S. Alexander
Butte, Montana

Yesterday I received the four video tapes of MIT IAP Cold Fusion Day, which I ordered. Though unedited, I found them to be very informative and they gave me an insight to the CF debate.

Dr. Hagelstein was interesting, inconclusive, and more than a bit over my head. Dr. Johnson was impressive and much easier to follow, though he seemed to play games. The latent heat of one gram of water is sufficient to evaporate one gram of water. When molecular "dihydrogen" forms from atomic hydrogen, this heat would by inference be about the same as the latent heat of water. How does this explain "life after death"? Pons and Fleischmann had many grams of water evaporate. How can you have an engine that runs on water if there is no excess heat? He seemed to be scrambling to explain how hydrogen can be transformed without a major energy process being involved. To a senile mechanical engineer, the more I understand the more it sounds like politics. Perhaps the emperor has no clothes. It was good that you broke up the sparring match at the end as neither one seemed to be going any place.

The presentations by Griggs and Werjefelt were excellent. I hope that Werjefelt can get his act together and produce a working model very shortly.

As a side discussion to the overheated rotor [of Griggs], aircraft tires will occasionally experience a special form of "hydroplaning" which melts the rubber just as though it had landed without rotation on a red hot surface. Typically the landing was "ropy" and high speed on a wet or icy runway. The rubber is removed to the cord with a molten surface remaining. The damage appears to have formed in an instant without the usual abraded appearance.

The standard explanation is that friction produces steam, which melts the rubber. Melting takes time for conduction. During a wet skid, a renewed liquid water surface should provide abundant cooling and act as a lubricant to reduce friction and heating.

Could this be another form of hot Hydrosonic rotor or CF (sonic activation-sonoluminescence) of water? There must be lots of noise, cavitation and shock waves when a tire touches down at high speed on a watery surface. The aircraft/tire industry did tests on hydroplaning. Perhaps they discovered CF and didn't know it.

Hydroplaning by itself should not produce excessive heat from friction as wheel (torque) rotation supposedly ceases. F x d = E.

When high strength steel forgings are electroplated they must be heat treated to prevent "hydrogen embrittlement" and subsequent failure while sitting on the shelf. The traditional explanation was that the hydrogen placed the outer surface of the forging under great compressive stress due to the hydrogen being absorbed and physically expanding the metal. None of this makes sense as the classic method of making a structural component resistant to tension failure is to place the critical region in compression by shot peening, shrink fit sleeves, or wire/fibre windings, etc. Hydrogen embrittlement must in fact be an explosive failure due to CF. CF may similarly explain the sudden failure of large, hot titanium billets after they have been cooled with water.

Thank you for running a difficult meeting very well indeed. I hope that the ICCF5 meeting in Europe was a success and that you have lots of good things to report.

G.S. Clark
Ottawa, Ontario, Canada

I have received your new publication, *Infinite Energy*, and have found it most informative and helpful to our own project work in the new energy field!

Cold Fusion has always been a bit of a mystery to me, but I don't believe that this area of energy R&D has ever been given a fair shake by our present so-called "scientific establishment." It has always seemed to me that the same establishment that denounces all CF project work, will at the same time commit tons of money to "hot fusion" without blinking an eye; it seems to me that they have some kind of *comedy act* going, which most of us can't appreciate!

New Energy Times Archive

Enclosed is a copy of our latest *S.E.A. Journal*, June/95 Edition, for your review, interest, and reference. As you will note, this project work is in the area of electrical/electronic units and systems, which you apparently are not yet "up-to-speed-on," according to your first *I.E.* edition. Frankly, some of us are now quite convinced that these various electrical hardware projects are the real way to go in the new energy field, since some have already established their "proof-of-principle," but need much more work and effort before practical applications are at hand.

What we see in these various electrical hardware projects, such as the Wootan/McClain. MRA units, is that once a working phenomenon has been established, such as their 1:1 transformer windings over Ba-Fe magnets; these become quite solid and "non-quirky" and are fully repeatable—they work every time.

On the other hand, some of the components within the various CF projects that we've heard about seem to be quite "quirky," and are generally not repeatable phenomena, but then we don't have all the info that you now have in the CF field. Also, it appears that the CF projects will have a time-degradation problem, which will not be severe for the electrical new energy projects, as experience is now showing.

The enclosed two letter copies —to the I.N.E. (Institute for New Energy) and to *Explore* —will provide you with some data on the Swiss M-L Converter, which is an outstanding hybrid type of New Energy system. This remarkable N.E. system has been around for over a decade and yet the "dumb schnooks" of the establishment are generally unaware of its existence and significance!!

Some of my colleagues in this field have criticized me for the "uncouth" tone in some of my letters, but I believe in calling the shots the way I see them, and the present scientific establishment deserves nothing but *fully expressed contempt*, in my view!

Don A. Kelly

It's been a couple of days since I've received the copy of your magazine, and I realized that I hadn't thanked you for it. I must say that I think it is a wonderful issue. I only saw two issues of Wayne Green's publication, and my impression of it was that it seemed to be a bit flaky around the edges. Your *Infinite Energy* doesn't give me that impression at all. In fact, the whole tone of your magazine is a big improvement. It gives the cold fusion industry a much more credible image to have an editor/writer of your skills dealing with the subject manner. Jed's writing in particular reminds me of Jerry Pournelle's columns in *Byte Magazine*. The drawings and explanations that accompany the articles also remind me of the old *Byte*, as well. If there is a seminal publication for this industry that serves as a nexus for the broad dissemination of information, like *Byte* was for the computer industry, I hope it is this one. The best of luck and my compliments to you and your staff.

Michael T. Huffman
Seattle, Washington

I hope that you are getting lots of subscriptions to *Infinite Energy!* If ZPE [zero point energy] turns out to be important, then you have got the ground floor of mankind's next big, new adventure!

I read Sapogin's paper hastily in Hal Fox's *Cold Fusion Source Book*. It struck me as just another way to introduce jitter in classical mechanics, and not necessarily the best way. However, I must take another look at it.

It is ironic that Hal Puthoff has been the guru of ZPE and therefore believes in its possible real-world applicability, and yet when the MRA [Magnetic Resonance Amlpifier] was submitted to him (and he told me that he was prepared to believe it if it tested OK) he & Scott Little found that the measurement of Energy Input/Output was flawed by the inventors failing to take into account the Phase Factor in computing power for an AC circuit.

I don't know what to believe yet, because the inventors tell me that when Puthoff and Little introduced extra circuitry to test their MRA, they forced the nonlinear MRA back into linearity and therefore got normal results. I hear anecdotal evidence of over-unity tests, but nothing conclusive. The retired physicist, Hodowanec, is trying to build a stand-alone MRA and has "nearly" succeeded. As Hal Fox says, "the Jury is still out on the MRA."

In the theory that I presented of the F&P effect, the resonant tunneling probability would be so small (unless the excited deuteron had the correct energy to 100 decimal places) that it would take 10^10 years for a 50% probability of tunneling through the Coulomb Barrier. However, I claim to have shown that when one (following Schwinger) includes the ZPF of the deuteron lattice in the analysis, this causes "line broadening" that enables the tunneling to occur within 8 femtoseconds! Thus it would seem that the cosmic ZPF facilitates the nuclear fusion (d + d to He-4), which provides the excess heat.

It could turn out to be that other and more direct ways of tapping the ZPF can be developed. Possibly the Hydrosonic Pump works by ZPF.

Even if the Hydrosonic Pump and its rumored large-sized Russian improvement are validated, it seems to me that one can *never* make a stand-alone device out of such, even by cascading, for the following reason: I sent you an example of how Werjefelt could cascade several larger and larger motor-generator combinations to get a stand-alone.

But Griggs told me that the best turbo-generator he can find has an efficiency of only 67%. That means that in order to get stand-alone, he would have to produce extra thermal energy at the rate in excess of unity of 1/0.67 = 1/(2/3) = 3/2 = 1.50 = 150%. Since Griggs told me he can't seem to get more than 40% over unity, it seems that he is doomed to never to be able to exhibit stand-alone; but seemingly *nothing* less than stand-alone will ever convince the critics!

Dr. Robert W. Bass,
Registered Patent Agent

Overall, I am very pleased with this new magazine. It was better than I expected, and I was expecting it to be good because its editor, Eugene Mallove, had already proven himself as a competent editor with the first three issues of *"Cold Fusion"* magazine.

As an improvement, it seems Mallove has learned from his previous experience: gone are the irritating complaints about "skeptics" and those who want to hold back progress. Who cares about such people, anyway? Not me, and I don't want to read about all the a—h's in the world. Fortunately, Mallove spares us his earlier bile.

Another improvement I see in Mallove's editing is a nice focus on attaining *Scientific-American* style readability. He said he was going to do this, and he has delivered. Not a single article required specialist knowledge to understand, because unfamiliar

New Energy Times Archive

concepts get explained when they are used, and there aren't that many unfamiliar concepts presented in the first place. If you can read *Scientific American*, you can easily read *Infinite Energy*.

Note that some of the articles are less technical and more human-interest. For example, the lengthy article by Michael Huffman, about his trip down Griggs lane, was a real treat. It is a fascinating first-person account, and a real eye-opener on Griggs-related devices.

There are other human-interest treats, and I'll just mention that O.J. gets double-billing along with CF in a cartoon from the Copley News Service.

Overall, *Infinite Energy* is a superb effort, and I highly recommend it to anyone who wants to keep up with CF activities. However, as someone else has asked, will it survive, given the early demise of *"Cold Fusion"* magazine? Overall, I see many encouraging signs in this magazine that it will survive: specifically, there are many and various ads, well placed and tastefully positioned here and there. Thus, Mallove seems to be doing a good job at getting ad revenue.

Another good sign for *Infinite Energy* is its roster of talent: Hal Fox is the associate editor. Chris Tinsley is a contributing editor (Chris, from the UK, was one of the bright lights in the early Mallove-led *"Cold Fusion"* days). Our own Jed Rothwell is another contributing editor and has an article on Mizuno's proton conductors (a nicely done article, by the way, with human-interest content about the history of Mizuno's CF efforts). Given Jed's Japanese language proficiency, he is just the man to cover the Japan beat. And the scientific advisory board is equally solid looking: Robert Bass, John Bockris, Dennis Cravens, Peter Glück, and Edmund Storms. Overall, *Infinite Energy* has a very nice lineup of talent, in all departments.

What about the name, *Infinite Energy*? My own reaction when I first saw it was real surprise because it sounded like a wild exaggeration at first glance. But once I got over my initial shock, I found that I liked the name, and that it seemed strangely appropriate. Oddly enough, on the first page of *Infinite Energy* is a picture of Arthur C. Clarke, and the text of a letter in which he reports essentially the same reaction to the name. Then, on the next page, Mallove gives his own justification for the name. Whoever thought up this name, I have to give him credit [Ed. Note: It was Gene Mallove.], because we really don't need another title playing on *"cold fusion"* in some form. As it is, the subtitle is "Cold Fusion and New Energy Technology," and that is enough.

Kurt Johmann
Gainesville, Florida

Congratulations on your publication of Volume 1, No.1 of *Infinite Energy.* It makes us all feel good that your hard work and tenacity have borne fruit. We at Quantum Nucleonics wish you success, both financially and scientifically. Best of luck and best regards to you and your team.

Nelson Ying, Ph.D.
Lake Buena Vista, Florida

Good Bye Fossil Fuels...Welcome to the New Energy Age!

America's ONLY Inventor's Magazine!

Inventors'

DIGEST

Since 1985 **INVENTORS' DIGEST** has been giving inventors —just like you — the information they need!!! Every good idea deserves a chance...but where to start? Take advantage of our special subscription offer and your questions will be answered!

•••••••• 1-800-838-8808 ••••••••

SPECIAL NO-RISK OFFER!!!

Call today and we'll put your first issue in the mail...take a look...you're under no obligation (except to your invention!)!!! Six issues per year. Subscription rate: $22/yr.
INVENTORS' DIGEST, 4850 Galley Rd., Ste.209
Colorado Springs, CO 80915

Order your set of *ICCF5 Video Tapes* and/or *MIT Cold Fusion Day VideoTapes* Today!

(see ads, pages 1 and 55)
You will *not* be disappointed!
Cold Fusion Technology
Box 2816
Concord, New Hampshire 03302-2816

Fax: 603-224-5975

New Energy Times Archive

Highlights of the Fifth International Conference on Cold Fusion

by Jed Rothwell

ABSTRACT: Highlights of the Fifth International Conference on Cold Fusion (ICCF5) are reviewed. A live demonstration system from Clean Energy Technologies Inc. showed 300% to 1,000% excess energy. Wide-ranging positive results in both excess heat and nuclear products were reported from E-Quest, U. Milan, Osaka National U., Mitsubishi Heavy Industries, NTT, the Japanese National Laboratory for High Energy Physics (KEK), Los Alamos, BARC, Amoco Production Company, Shell Oil, Harwell Laboratory (in retrospect!), and others. An electrical engineer from Bechtel Corporation gave a superb talk on the economic and technical aspects of the commercial development of cold fusion energy.

This is a brief report of my impressions of the Fifth International Conference on Cold Fusion (ICCF5), April 9-13, 1995, Monte-Carlo, Monaco. These are things which I thought were significant. Other people would describe the elephant differently. Any conference or trade show is a mixed bag: a few great papers, a lot of ordinary stuff, some disappointments, and many boring papers that are over my head. As I said in my review of ICCF4, I have no background in nuclear physics, and I do not make comments about subjects beyond my level of expertise. I can grasp the hands-on details of experimental setups but I have no knowledge or interest in theory

Dr. James Patterson (L) and Dr. Dennis Cravens with the Patterson Power Cell Demonstration at ICCF5 *(Photo: EFM)*

First, a word about media: the Book Of Abstracts is about 150 pages. It is well organized for once. Abstracts are numbered in a coherent scheme. Some of the talks were so good they call for long individual analyses. I have barely touched upon them here: Storms [1], Cravens [2], Klein [3], and Srinivasan [4 and 5], and the upcoming Piantelli patent, which was discussed informally during the conference.

The first lecture was the Critical Overview by Storms [1]. It was one of the best. Storms is essential reading for anyone who wants to understand this field. He distributed preprints of his upcoming *Fusion Technology paper* "A Critical Review of the 'Cold Fusion' Effect" which I highly recommend.

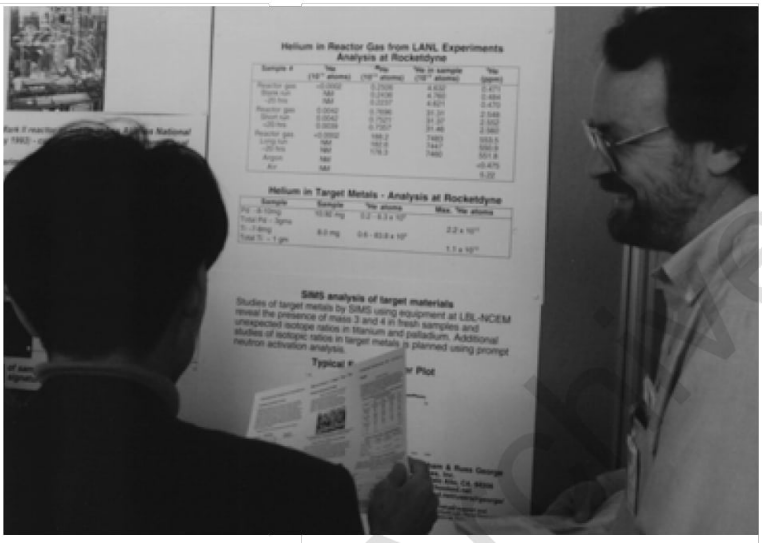
ICCF5 Participants in Main Meeting Room at Hotel Loews
Photo: Courtesy, Alexander Krivoshein

Patterson's company, Clean Energy Technologies, Inc. (CETI), got together with Dennis Cravens and brought to the conference a demonstration cell in a flow calorimeter. It worked spectacularly well. Cravens [2] discussed it on the first day. The device output 3 to 5 times input energy, ignoring energy lost to electrolysis gases, and as much as 10 times input if you include various factors such as electrolysis gases and the heat lost from the cell container. I will describe it in detail in a later communication (see page—). Briefly, input power was usually held at about 0.4 watts (current times voltage, I*V), although on the last day it was raised to 0.8 watts for a while. The flow rate through the cell was 10 ml per minute. When the machine was first rolled into position and turned on in the morning, there was no excess for 10 or 20 minutes, and the temperature Delta-T fluctuated around 0.2 °C, indicating about 0.14 watts output. The rest was lost to known heat leaks from the cell container and to the effluent gasses from electrolysis, which were measured with a gas flowmeter. As the reaction turned on, the Delta-T gradually rose to about 2 °C, and sometimes rose as high as 4 °C, indicating 20 to 40 calories per minute, or 1.4 to 2.8 watts.

Patterson's device is described in U.S. Patents 5,036,031 and 4,943,355. It is a thin-film, light water system. It incorporates co-polymer beads with a flash coat of copper and electrolytically deposited thin film coatings of nickel, palladium, and another outside layer of nickel. CETI has agreed in principle to work with some of my contacts at major institutions, especially Japanese National Laboratories and Universities. They asked me to make arrangements, which I have been hustling to do. CETI is very cooperative and open. I have been following their work for about a year. Few other scientists seem to be as willing to share information, and almost no other scientists in the field think as quickly or solve problems with such dispatch. A

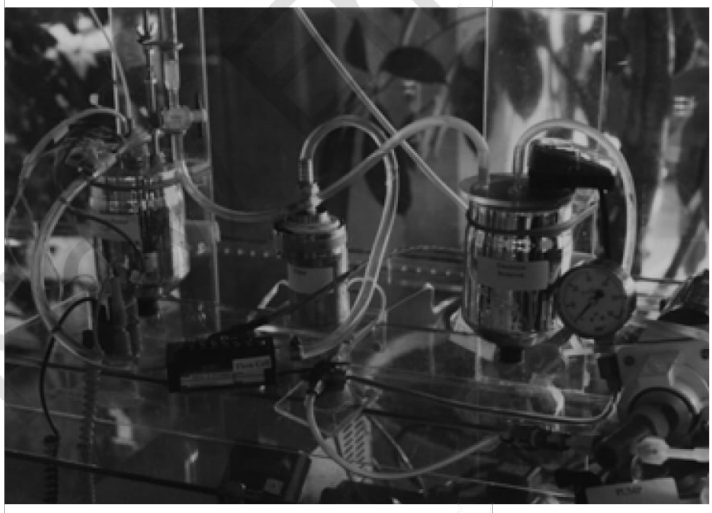
while ago they had problems with high temperatures and pressures destroying the beads and melting the plastic cell containers. They designed new beads with an extra outer layer of nickel, and they found new, temperature-resistant cell materials. They are oriented toward fixing engineering problems and building practical, commercially useful systems. That is what the field most needs.

The CETI demo system is fairly predictable, well controlled, and well-behaved, although it did get a bit quirky in the harsh conditions of the ICCF5 hallway. During breaks, the hotel coffee pots kept tripping the circuit breakers. This sent jolts of power through the transformer, which crashed the experiment. The CF reaction started up again *every time*, usually in about 10 minutes. The high precision flowmeter unfortunately did not survive the beating; the batteries and power supplies in it burned up. Fortunately, the low-precision flowmeter —a 10-ml laboratory supply graduated glass cylinder plus stopwatch—cannot be affected by power outages and excess voltage. The experiment was subjected to other abuses: the cart holding the experiment was wheeled up to a hotel room every night, carried on elevators, and pushed around. Cravens even lifted the cell from its container to show it to people while it was running! Yet in spite of this, the reaction started up in the morning after 10 or 20 minutes of electrolysis, although on the last day it took about a half hour, and the power was turned up higher than before. The fact that the cell survived this treatment at all demonstrates that this is one of the most robust and practical electrochemical CF systems yet developed. By the last day, the batteries in the differential electronic thermometer got weak and a minor 0.2 °C bias appeared between them, which could be observed by switching the leads to the input and output thermistors. This was not significant, because the Delta-T ranged from 2 to 4 °C when the reaction was on, and it was less than 0.4 °C when there was no excess heat.



Russ George of E-Quest Sciences at poster presentation of helium results from the company's "microfusion" reactor. *Photo: EFM*

I asked a number of the leading CF people what they thought of the demo and the Cravens talk. Some of them were enthusiastic. Peter Hagelstein spent a long time with Cravens going over the instrumentation and results step by step, in his ultra-careful, thoughtful fashion. But when I asked other leading CF scientists what they thought, they evaded me or expressed open hostility. The excuses and nonsense they gave me would be worthy of the most pathological "skeptic." I believe they are jealous. They cannot bring themselves to admit they have been trumped by the light water approach. The most pathological skeptic on earth himself, high-energy physicist Douglas Morrison from CERN, said that he could not judge the experiment and he would have to have Tom Droege, an engineer at Fermi Lab, look at it before reaching any conclusion. That was, at least, a lot funnier than the responses of the CF scientists who oppose light water experiments.


Close up view of Patterson Power Cell Demonstration at ICCF5. Cell is in dewar chamber to the left. *Photo: EFM*

Sapogin [6] described Russian ultrasound cavitation machines that are related to the Griggs (Hydrosonic Pump) device, only they far more efficient. These are designed by a materials scientist, Dr. Yuri S. Potapov, in Kishinev, Moldova. The device inputs 4 kilowatts of electric power into its turbopump, and it outputs 12 kilowatts thermal. So far, Potapov has produced four models, with increasingly better performance. The earliest, least effective model gave excess heat with a C.O.P. ranging from 130 to 150%. Potapov has set up a corporation with four factories, and they have already sold thousands of these units. I have arranged to purchase some units, which will now be tested here in the United States. Several contacts at well-qualified laboratories have agreed to test them.

The Potapov device may or may not tap the same source of energy as the electrochemical CF cells and the E-Quest device. I have no idea whether it does or not. One startling piece of evidence seems to indicate that it may not. Sapogin reports that the device was run for many months in a closed circuit yet it did not generate any significant level of tritium or other radiation. (Other possible nuclear ash such as helium-4, has not yet been measured.) Sapogin thinks he can explain this with his "unitary quantum theory" which he published in *Il Nuovo Cimento*. [7] I am glad it is not my job to explain it! [See also Sapogin's ICCF5 presentation in this issue of *IE*.] This baffling result may appear to contradict results from E-Quest, the Naval Weapons Center, and others who have found helium commensurate with a nuclear reaction. Perhaps there are two different, unrelated processes at work, or maybe there really *is* helium-4 production in Potapov's devices. From the

New Energy Times Archive

Roger Stringham (C) and Russ George (R) of E-Quest Sciences discuss results with Earl Lagergreen of France. *Photo: EFM*

Analysis of Helium in Reactor Gas from LANL Experiments
—Analysis at Rocketdyne (E-Quest Sciences)

Sample #	^{3}He (10^{14} atoms)	^{4}He (10^{14} atoms)	^{4}He in sample (10^{14} atoms)	^{4}He (ppm)
Reactor gas	<0.0002	0.2506	4.632	0.471
Blank run	NM	0.2436	4.760	0.484
~20 hrs	NM	0.2237	4.621	0.470
Reactor Gas	0.0042	0.7696	31.31	2.548
Short run	0.0042	0.7521	31.37	2.552
<20 hrs	0.0039	0.7357	31.46	2.560
Reactor gas	<0.0002	188.2	7483	553.5
Long run	NM	182.6	7447	550.9
~20 hrs	NM	178.3	7460	551.8
Argon	NM			<0.475
Air	NM			5.22

standpoint of business and technology, it does not matter if there are two processes or two hundred.

Griggs [7] gave a surprisingly well-received talk about his ultrasound device. He described instrumentation, results, and his efforts to have the machine verified by scientists. He said that more than 40 scientists have visited him over the last few years and *not one of them* has found a mistake. Strictly speaking, that is not true. I found a glaring error and so did a good scientist I know who visited Griggs a year ago, but those were errors with newly installed test equipment that were soon corrected. Nobody has found any error in the overall conclusions. During the past few years, as all of these scientists visited, Griggs listened to their suggestions and improved the experiment in many ways. His biggest improvement was to add a dynamometer — a "Lebow" brand Eaton torque sensor model 1805-5K. This gives him a second, independent method of measuring input power. He has found that the mechanical power from the motor closely matches the manufacturer's performance specifications. Recently, after he modified the rotor, Griggs began experiencing problems with cavitation damage and with massive plating out of (or production of?!) copper from an unidentified source. He has been working with experts from Georgia Institute of Technology and NASA to resolve these difficulties. They plan to use transducers, high speed cameras, and other high-tech tools to learn more about what is happening inside the machine.

Stringham and George of E-Quest [9] talked about their spectacular results in greater detail than they have been willing to share previously, but still not in enough detail to satisfy me. They are getting massive helium-4 production, isotope shifts, heat and so on. Last summer they ran experiments at Los Alamos. At ICCF4, John Huizenga insisted that he would only accept helium analysis results from Rockwell International, which is widely viewed as the best laboratory on earth for this type of work. So, E-Quest shipped samples of gas from the Los Alamos experiment in stainless steel collection bottles to Rockwell's facility in Canoga Park, CA, where they were analyzed by B. Oliver. The Rockwell tests revealed definitive proof that the excess heat is associated with a nuclear reaction. Experiments that did not generate excess heat showed a background of 0.4 ppm helium. Experiments that did generate excess heat yielded helium far above that background level, at levels as high as 552 ppm, about 100 times atmospheric concentration (about 5.7 ppm), and over 1,000 times experiment background. Rockwell also looked at the ratio of ^{3}He to ^{4}He as well as the ratio of ^{22}Ne to ^{4}He in the samples and found that the isotopic ratios prove the helium could not possibly have come from contamination from normal terrestrial helium. During the talk, George mentioned that an extensive SIMS analysis performed by him at Lawrence Berkeley Laboratory showed dramatic isotope shifts in some of the high-Z trace metals, especially titanium. I find the E-Quest work tantalizing but frustrating. I do not have details, patent applications, or any way of getting a gadget to test myself. That would not matter if this was yet another "me too" milliwatt level, intermittent reaction, but it is one of the most important experiments in the field, so it deserves wider replication and exposure.

Other leading experiments are also being kept too secret for my taste, especially those of Arata, and Pons and Fleischmann. Detailed technical information about cold fusion devices must be shared if the field is ever to be commercialized, and the best mechanism for sharing it is the patent or patent application. E-Quest and many other CF workers in the U.S. have applied for patents, but they have virtually all been blocked, except Patterson's (and one just obtained by MIT-affiliated researchers in May 1995—see their patent, reproduced in full, in this issue of *IE*). The patent system is a splendid institution; it allows us to share information, preserve property rights, and to foster progress. The slow progress in cold fusion demonstrates how vital the patent system is, and how much effort

New Energy Times Archive

is wasted when the government fails to do its job. The Japanese and the Italian governments have granted many patents for cold fusion, the continued intransigence of the U.S. government may hurt U.S. competitiveness in the future.

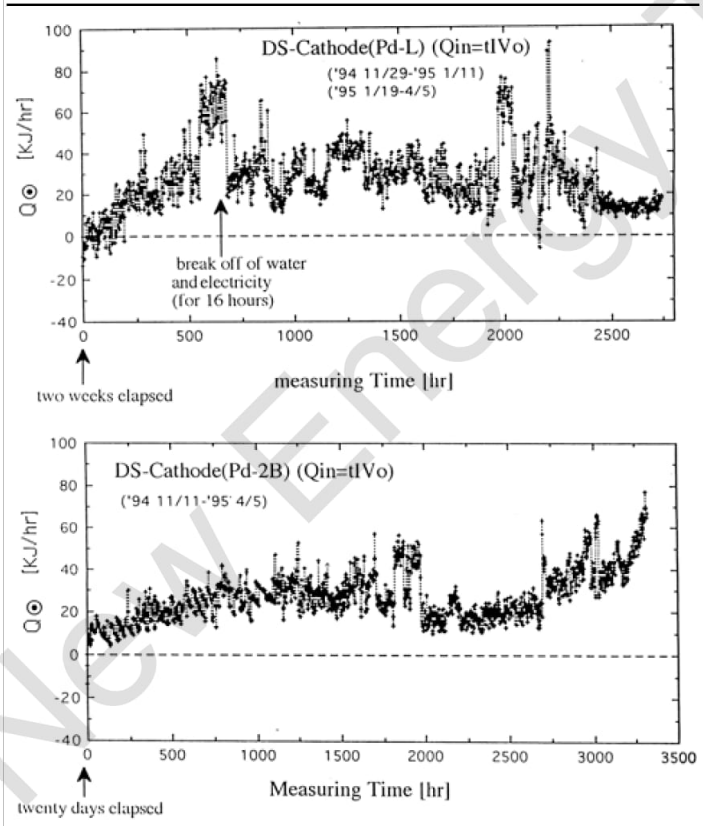
Dr. Piantelli from the University of Siena, Italy did not attend the conference, but his friend Bill Collis was there, and he gave us an informal update on the work. (Collis is British; he lives in Italy and speaks fluent Italian. Piantelli said that he does not understand English well enough to make it worth his while to attend the conference, but he sent his regards). Piantelli has been granted a patent which will come out in July, he hopes. He is publishing a new paper in *Il Nuovo Cimento*, and he was chairman of a recent important CF conference in Italy. Up until now he has kept secret many key aspects of the experiment, but now that he has been granted a patent he discusses all details. Collis described three aspects of the experiment that have been kept confidential:

Prof. Hideo Ikegami, National Inst. for Fusion Science, Nagoya, Japan and Dr. Reiko Notoya of Hokkaido University. *Photo: EFM*

1. The nickel should be prepared with special surface treatments that will be described in detail. I do not know the details of this particular preparation, but I expect it is similar to the ones described by Storms, McKubre and many others. They involve cleaning the surface, removing impurities, checking for and in some cases eliminating cracks and other deformities by sanding, etching or scaling the surface, or simply by rejecting damaged metal. This is an important aspect of all CF experiments.

2. The metal sample is placed in a magnetic field of several kilogauss. This greatly enhances the absorption of hydrogen in nickel at high temperatures. A permanent magnet will do the job, but Piantelli finds it more convenient to use an electromagnet. When the magnet is turned off, the sample degasses and after a while the reaction stops. This is excellent news; it means the reaction can be controlled.

3. To trigger the reaction, Piantelli discharges a capacitor into the heating coil, giving it a brief jolt of energy. This sort of technique is widely used with other types of CF. A shock of thermal or magnetic energy will often trigger a reaction that is sufficiently loaded and ready to begin reacting in other respects. Any form of disequilibrium might help, even a vibration, like a gentle tap on the cell. These "triggers" have also been known to interrupt a reaction.



Results shown at ICCF5 by Yoshiaki Arata and Yue-Chang Zhang. Excess heat characteristics of two examples for long periods. Excess heat plotted is (output-input) is in KJ/hr. Note: 10 watts = 36 KJ/hr. Upper run had 5 grams Pd, lower had 3 grams.

Prof. Jaques Vigier (L) of France, an Editor of *Physics Letter A* and Dr. Francesco Celani of INFN, Frascati, Italy. *Photo: EFM*

I will describe additional details about the Piantelli experiment in a later communication after I read the *Il Nuovo Cimento* article.

Arata [10] described his double-structured cathode palladium black experiments in considerably more detail than his two most recent papers. He reported "the chemical reaction energy of 0.1 mole Pd-black used is only 4 kJ, but more than 200 MJ of excess energy was continuously produced for over 3,000 hours at an average rate of 50-100 kJ/hr [14 to 28 watts]" Arata's English is poor and the lecture was difficult to follow, but I learned a lot from the poster. Kawasaki and I have done a rough translation of his May 31, 1994 paper into English. I should finish it up and incorporate more of the information from the poster. Arata also described a model that he believes explains the reaction, and accounts for the good performance of palladium black in pure deuterium gas.

A number of Japanese corporations showed up with mainstream CF results that I would have described as "spectacular" a few years ago, including large heat bursts, boil-offs, and the like. None of them holds a candle to people like Patterson or Patopov. Iwamura [11], from Mitsubishi Heavy Industries, reported X-rays, neutron emissions and possible transmutations, and concluded, "Although we cannot identify where these Pb atoms

New Energy Times Archive

came from (contamination or generation), we can say that anomalous nuclear reactions must occur in the electrochemical cells at room temperature." Itoh [12], also from Mitsubishi, reported on vacuum chamber gas release experiments somewhat similar to the NTT thin film work reported at ICCF3 and elsewhere. Shikano [13] of NTT reported continuing progress with those experiments.

Isagawa [14], with the Japanese National Laboratory for High Energy Physics (KEK), got a number of spectacular results, including three boiling events and an "enormous" heat burst. "Under constant current conditions, the cell voltage and the cell temperature were increased gradually and all of a sudden sharply increased to boiling. . . . It was just during the calm period about 6 hours after the first boiling that the enormous heat release was observed. The temperature of the cell of about 100 ml in volume increase by 7.5 °K (from 83.4 °C to 90.9 °C) in 13 minutes. The cell voltage showed a dip correspondingly. The excess heat can be estimated to be 6.8 W, about 110% with respect to the input electrical power. . . . Boiling occurred 3 times, the last episode continuing for about 16 hours, in the former period violent but in the prolonged later period rather gentle; the cell was driven almost to dryness." KEK has superb instrumentation so nobody can deny the results are real and beyond chemistry. This is not be-all, end-all performance compared to the Big Guns in the field like Patterson, but it is good for public relations. A few years ago a number of leading "skeptics" including Morrison touted the KEK laboratory. For example, in his Cold Fusion Update # 7 (Dec. 1992) Morrison wrote:

"On the other hand the most complete experiment in Japan according to the book of Abstracts, has been carried out over three years by Isagawa et al. at the National Laboratory for High Energy Physics, KEK – it was not chosen for presentation and was not mentioned – their evidence on excess heat, neutrons and tritium was against Cold Fusion although they found many artifacts which at first had appeared as real effects. . . . In Japan the two most careful experiments have both given strong evidence that Cold Fusion will not give excess heat. They are the KEK experiment which was rather complete, and the Kamiokande experiment."

Dr. Martin Fleischmann, at ICCF5 tea break, makes brilliant scientific points to Kikujiro Namba of Japan's Technova, Inc. *Photo: EFM*

Now that KEK has found definitive evidence of heat beyond chemistry, I expect Morrison will declare that they know nothing about physics and their experiment is flawed for mysterious reasons he cannot describe. He showed no sign of believing any of the data. He repeated verbatim his statements from previous conferences. Subsequently he wrote an absurd article in the *Tribune de Geneve* (31 May 1995) with lead-in and title, "Investors Doubt Cold Fusion. Perhaps Its Second Death — The Source of Energy Revealed in 1989 has Already Been Denounced by Many Scientists. The Enterprises Which Have Invested in This Sector Now Seem to be Retiring on the Tips of their Toes."

(L to R) Dr. David Thompson, UK, Dr. Michael Melich, U.S. Naval Post Graduate School, and Fred Jaeger, ENECO, Salt Lake City. *Photo: EFM*

Claytor's abstract [15] reports continued progress at Los Alamos. "Over the past year we have been able to demonstrate that a plasma loading method produces an exciting and unexpected amount of tritium. In contrast to electrochemical [methods], this method yields a reproducible tritium generation rate . . . We will show tritium generation rates for deuterium-palladium foreground runs that are up to 25 times larger than hydrogen-palladium control experiments using materials from the same batch. The reproducibility of the technique and the large signal-to- noise ratio over background has allowed us to vary parameters that have been difficult to investigate with previous methods." Unfortunately, Claytor and his colleagues Tuggle and Jackson were not able to attend the conference. I hope they can submit a paper to the *Proceedings* anyway, even though that might not be strictly in accordance with physics conference traditions.

On the last day, Klein [3], of Bechtel Corporation, gave a superb talk on the economics and ABCs of developing cold fusion into a practical form of energy. This is required reading for anyone interested in that subject (see text in this issue of *IE*). Since this is my main concern, I am happy to report that his talk held no surprises for me, but he did a superb job in summarizing the key issues in business and technology. He pointed out, for example, that solar photovoltaic cells use zero cost energy, but they still cannot compete with conventional sources because the fuel cost is not the only economic factor. He said that a cold

New Energy Times Archive

fusion power reactor might be economical at the large scale, like today's coal or fission; or it might be economical at the substation level; or it might even be economical in home generator units operating at 10 or 20 kilowatts, in which case people will gradually unplug from the power distribution network. This is bold speculation, and Klein is to be commended for talking about it, because his corporation's main line of work is in large-scale energy installations like oil refineries and power stations, so he is speculating about something that may put Bechtel out of business. He did not describe a logical conclusion to this train of thought. There is no reason to suppose that miniaturization will stop at the level of a 20-kilowatt home reactor. Washing machines, coffee pots, children's toys, earphones and pacemakers may someday have built-in CF power.

Klein discussed many technical requirements for a practical source of energy, such as the need for a method of throttling the energy. It would be nice if we could turn on the flow of energy, turn it up, down, and then quench it. I would like to add a comment: while this is generally true, there are conventional sources of energy that cannot be quenched, and that can only be throttled to a certain extent. The best example is a ton of burning coal: once you light it, you have to let it burn. That is why coal is relatively inflexible and limited to large scale applications where continuous energy is needed and instantaneous, fine control over the reaction rate is not required.

A scientist might think that the issues Klein discussed are premature, but they are not. If everyone in this field would move these issues to the top of his or her agenda, progress would be swift, and the field would be inundated with funding. Many scientists think that Klein and I put the cart before the horse. They believe a theory must be developed before the reaction can be controlled, and that discussions of engineering problems and commercial development schemes are premature. Events have proved these scientists wrong. Patterson has already shown a proof-of-principle demonstration device. Ultrasound excess heat devices are already being sold in large numbers at a profit. Cold fusion (or some form of energy similar to it) has already been successfully commercialized, so this discussion is not premature, it is starting two years late. The history of modern technology includes many examples of commercial products that were developed and sold before a comprehensive theory explained them, including such things as Marconi's long distance radio, airplanes, antibiotics, high temperature superconductors and aspirin. The latter two are not fully understood even today.

Many of the papers were disappointing, because many workers are stuck in the rut of trying to replicate the 1989 simple palladium-heavy water electrolysis method. This requires high-loading of deuterium into a Pd-lattice and other conditions which are nearly impossible to achieve. Why anyone would still be trying to use this method so many years after better methods have been invented is a mystery to me. Over the years many excellent alternatives to pure palladium have emerged: thin film [2], palladium black [10], light water [2, 16, 17], ultrasound [7, 8, 9], proton conductors [18]. Other methods, like sparking [19] and glow discharge [20, 26], have not been as widely replicated, but they show promise. Yet the majority of scientists in the field ignore these promising approaches and continue using only palladium. Instead of selecting the easiest and most successful methods, they insist on using the oldest, least effective, and most frustrating technology, as if they were computer scientists who insisted on building a vacuum tube machine in the age of transistors. Many papers describing the heartbreaking difficulties these people face: the high loading, surface treatments, problems with cleanliness, and the many heroic techniques they are forced to employ. Kunimatsu [21] and others continue to search for ways to improve loading in palladium with electrolysis, instead of using other methods in which loading does not matter. Scientists who use pure palladium must wait 30 days or longer for a tiny, marginal, excess heat reaction to flicker on—a reaction which often abruptly dies. Contrast this with the E-Quest device, which turns on in a fraction of a second and produces a 300% excess, or the Patterson CETI cells, which turn on in 20 minutes and produce up to 1,000% excess. The Pd D_2O reactions seldom produce enough nuclear products to be detected with any real certainty. Okamoto [22] reported that the Japanese NEDO Icarus program, for example, saw only two excess heat reactions during the entire year, peaking at 16% excess. Six years of low-level results have failed to convince mainstream scientists that CF is real. Six more years will not convince anyone either. I was disappointed to hear about these puny results, but on the bright side, I asked Okamoto about the Icarus results, and he said their calorimetry is excellent, so they have no doubt that the 16% excess is real. (Okamoto is at the Tokyo Institute of Technology, not in the Icarus project.)

As I expected, Pons and Fleischmann [23] did not reveal any details about their recent work. They have not revealed much since 1992, even though they have achieved some spectacular successes since then, including long boiling events. Pons was suffering from a cold during the conference and did not attend most sessions, so Fleischmann gave two lectures. In my opinion, the major important point he made is that heat promotes the CF reaction. This is very important and it has been overlooked by many people in the field even though Fleischmann, Ikegami [24] and other mainstream leaders have pointed it out many times over the years.

In 1994, Srinivasan was forced to retract many of his excess heat claims for the nickel-light water cells. He told me that he found that many were due to recombination, but not all of them, and he does not retract the tritium findings. Apparently, the nickel cells, like palladium ones, can produce tri-

COLD FUSION TIMES

The Journal of the Scientific Aspects of Loading Isotopic Fuels Into Materials

Published Quarterly

Publisher and Editor
Dr. Mitchell Swartz

Annual subscription rate is $120.00. Single issues are $40.00. There is an extra postage and handling charge of $5.00 per order outside of the United States.

P.O. Box 81135
Wellesley Hills, MA USA
02181

New Energy Times Archive

tium with little or no heat. That was disappointing, but on the other hand Srinivasan reported a number of other extraordinary experiments from various labs at BARC that range from weird to extremely promising. He acts as a representative from India, because not many Indian scientists are able to attend these international conferences. He gave two lectures to cover the work of many other groups. [4, 5] His dynamic and fascinating talks move at such a rapid pace and touch on so many amazing topics, they leave your head spinning. I will have to watch the video and summarize what he said in a later communication.

There was an interesting contrast between Kennel, Hagelstein and Smullin [25] on one hand and Karabut [26]. In 1992, Karabut et al. first reported excess heat and gamma rays from a glow discharge experiment. Hagelstein has been working hard for the past few years to replicate this experiment, but he has achieved little success. Kennel et al. "call attention to various means by which false positive signals can be observed in x-ray and gamma spectroscopy." They cast doubt upon Karabut's findings: "The authors wonder if other researchers presenting data on gamma and x-ray emission from cold fusion experiments may have fallen prey to similar phenomena. However, it is most expressly not the intention of this paper to make the claim that all positive results are due to detector artifacts and faulty estimates of statistical significance. . . ." Kennel has not been able to replicate Karabut's gamma measurements, so naturally he has doubts about them. Yet at the same time, Karabut has improved the heat measurements with a single flow calorimeter, instead of three static calorimeters for each of the three main components. This puts the excess heat on much firmer ground. So perhaps the excess heat is real but the gamma rays are an artifact? I cannot judge gamma detection schemes. I have heard a great deal of sincere debate about detecting gammas, low level neutrons and other nuclear signatures, and I have seen serious questions about various techniques raised by supporters and opponents of CF alike, including, of course, Kennel and Hagelstein. On the other hand, I have never seen a single reason to doubt that flow calorimetry always detects multiwatt excess heat levels. Problems can arise at milliwatt levels, but never between 1 and 100 watts. The "skeptics" have offered various reasons to doubt flow calorimetry, but their ideas have no scientific merit. Although I know nothing about detecting gammas, I conclude that it must be easier to measure heat with 19th century techniques than it is to measure low level gammas with modern equipment. No serious scientist will dispute that flow calorimetry always detects multiwatt levels of heat, whereas many serious scientists like Kennel have shown how errors might creep into gamma detection.

Apollo 11 astronaut, Dr. Buzz (Edwin) Aldrin, the second person to set foot on the Moon, and wife Lois Aldrin— at ICCF5 as Guest Observers— share light moment with Dr. Scott Chubb of the U.S. Naval Research Laboratory, and Dr. Gene Mallove of *IE*.

DuFour, at Shell Research, [19] made the same improvement as Karabut, with equally good results. He combined several separate calorimeters for different components into one unified flow calorimeter, which accounts for all inputs and output. He continues to detect up to 7 watts of excess heat. It is good to see that the oil companies are seriously pursuing this form of energy.

Another oil company finally came of the woodwork. Amoco reported some old but extremely important early results. Eisner [27], of the University of Houston, described the 1989 experiments that he and Lautzenhiser and Phelps of the Amoco Production Company performed. According to Amoco's 1989 report [28], the first experiment "yielded a 30% energy gain over the life of the experiment (two months). In June 1989, the experiment was modified and a second run also yielded "about 30% excess energy until the catalyst become waterlogged." Other successful runs were performed. Their conclusion: "The calorimetry conclusively shows excess energy was produced within the electrolytic cell over the period of the experiment. This amount, 50 kilojoules, is such that any chemical reaction would have been in near molar amounts to have produced the energy. Chemical analysis shows that no such chemical reactions occurred. The tritium results show that some form of nuclear reactions occurred during the experiment." Amoco has superb closed-cell flow calorimeters, their signal to noise ratio is exceptionally high. They are world class experts in this type of work. They got excess heat far beyond the limits of chemistry and nuclear products in these early experiments. It is a shame they did not talk about it back in 1989, but at least they have set the record straight today. It is not clear to me whether they are still working on cold fusion or not.

As a humorous aside, let me add that when we showed the Amoco results to Morrison at ICCF4 in 1994, after the closing ceremony, he turned pale as a ghost and took off like a shot. This is one of the many nightmare results that "skeptics" wish they could forget, along with KEK, Mitsubishi, NTT, Los Alamos, E-Quest, SRI, Canon, etc., etc.

Hansen [29] described more about his detailed analysis of the 1989 Harwell data, which he previously discussed at ICCF3 and ICCF4. The Harwell experiments were performed in the summer of 1989 by inexperienced junior scientists, who mistakenly concluded that there was no excess heat. Hansen has more experience with electrochemistry and calorimetry than the Harwell researchers, and he was given full access to their data. The Harwell researchers relied upon hardware which they did not fully understand, and upon a sophisticated analysis which turned out to be unnecessarily complex. Hansen's linear regression "is much simpler and faster" than Harwell's technique. By using better algorithms with the same data, he achieved an order of magnitude better precision than they did. You might call this a triumph of software over hard-

New Energy Archive

ware. The Harwell experiments are not intrinsically important. Much better results have been achieved since 1989, and far better techniques have been discovered, so there is no technological imperative to look back at these early results. But for political reasons it is important to show that the conclusions published by Harwell were incorrect. In 1989 Harwell, CalTech, and MIT were held to be the "Big Three" that proved cold fusion does not exist. All three were later shown to be positive results. The best discussion of this is the 1994 *Journal of Physical Chemistry* paper by M. Miles. [30] No "skeptic" has ever published a scientific paper demonstrating that any major positive cold fusion excess heat results were wrong, but the big three negative results from 1989 evaporated long ago. For years, the "skeptics" have predicted that cold fusion would fade away, but their data and their conclusions faded away instead.

Fleischmann [31] talked about Harwell in his second lecture, titled, "The Experimenter's Regress." As he put it, "the judgement of whether or not a given result is 'negative' or 'positive' is frequently dependent upon the methods of data analysis used. . . . We present here a comparison of a number of 'historically interesting' data sets and show that the conclusions reached have frequently not been justified." This is an important piece of scientific history, and it should be explored someday. But I think that now is not the time to look back at old data. We should concentrate on present results instead. The old data from Harwell, MIT and CalTech do show convincing excess heat, but it is not as convincing as the Patterson demonstration cell, so if our goal is to bring mainstream scientists into the field I think we should emphasize the strongest data from the most recent experiments, rather than looking back at old data. Fleischmann's other point was that there is a lot to be learned by looking at old data.

There was a lot of good news at this conference. There were many fascinating breakthroughs. I was happy to see increased attendance this year by serious corporations and investors. Many Japanese corporate scientists were there, looking and learning, and not saying much. I would not expect them to say anything, but they came from companies that have already been granted patents, so I was glad to see that their quiet involvement in the field is continuing.

Yet, for all the good "vibes," I felt an undercurrent of pessimism and a sense that something is wrong with this field. McKubre voiced consternation that the field lingers on in a kind of twilight zone in the U.S. I think I know why. The political opposition is the main problem of course, but the other problem is that the focus of the research is wrong. There is too much emphasis on theory and basic science, and not enough on technology. Many of the inventors, businessmen and entrepreneurs at the conference agreed with me about this. An inventor friend of mine, who worked at Bell Labs on the first transistors, expressed the same frustrations I feel. He thinks researchers should try one approach, try another, build on experience, and aim for practical, near term R&D goals, letting the science take care of itself later. He said the CF scientists have to get out of this rut of repeating the same old experiments with old techniques year after year, long after better techniques have been discovered. "Why are these people so obsessed with loading?!? Why don't they try a method where loading doesn't matter!" He, and I, and other people oriented toward business R&D feel that some of the scientists misunderstand history. We think they are putting the cart before the horse. The scientists say that the mechanism of CF must be discovered and the theory must be completed before CF can be scaled up. History shows that technology evolves the other way around. Scientific theory follows in the footsteps of successful innovation and serendipitous discovery. Marconi first proved he could send radio signals across the ocean, then he began building an industry with the wrong technology (high power, long wave radio) and then finally years later the scientists caught up. They found out about the ionosphere and discovered that short wave radio works much better. The Wrights invented the airplane, and 15 years later a theory to fully explain wing lift emerged. Bell Labs developed a transistor in 1947 based on a faulty, incomplete theory. Four years later they developed a much better theory, and years after that people began making computers with transistors. Innovation comes first, theory and refinements follow. The devices from Patterson, E-Quest, Griggs, and Potapov prove that I am right about this. An effective demonstration system <u>can</u> be built now, even before a theory emerges.

I do not mean that a theory is unimportant! Theories are vital. The radio, the airplane, the transistor, good software development techniques and most other modern technology depends upon theories, but these innovations had to come first before theory could follow. Later, the two grew together in a synergistic feedback loop. That is the natural order of things.

When I talk about the need to put aside the palladium heavy water approach and try other methods instead, scientists often misunderstand me. One wrote to me in a plaintive tone: "There are good reasons to study the Pd system: it works, there is a lot of data on it, it gets high current density, many people have had an opportunity to scrub the data, etc. Please don't advocate quitting any particular avenue yet!" My friend missed the point. I am not advocating that we "quit" that avenue. I say we need to drop it temporarily, and to concentrate instead on what works spectacularly well today. We must build 20 kilowatt light water reactors so we can convince the world that cold fusion is real. That will bring in rivers of money — oceans of money. There will be plenty of funding to go back and finish up the palladium system. The Wrights built a pusher propeller canard airplane (with the elevator in front), but that did not spell the end of tractor propeller designs with elevators astern. Once the industry begins in earnest, scientists will be able to go back and explore any number of avenues, and develop any number of theories.

I expect the Potapov device will be verified. In that case, it is the most important, most practical, and most promising excess heat device yet invented. Given that fact, if it was up to me, I would schedule three days of discussion about the ultrasound, light water and other practical devices, and devote only a half day to electrochemical heavy water - palladium CF and other marginal techniques. The focus of a conference should be on methods that work, not methods which happened to be discovered first. We do not devote semiconductor conferences to discussions of point contact devices, even though Bell Labs invented them first. The purpose of this research should be to invent practical, profitable machines to improve people's lives and reduce pollution, not to explore esoteric aspects of metal hydrides. If the academic side of CF is emphasized, the field will wither away. Few young people are involved and

New Energy Times Archive

there is still enormous opposition from academia. I believe that the only hope is to demonstrate working devices to industrial corporations, and to get more patents. Fleischmann and I talked about this briefly, and he strongly disagrees with me. He feels that the academic approach is good for the field.

Footnotes

(The ICCF5 paper numbers listed here are from the Book of Abstracts.)

1. E. Storms, "A Critical Overview of Cold Fusion," ICCF5 paper # 101.
2. D. Cravens, "Flow Calorimetry and the Patterson Power Cell (TM) Design," ICCF5 paper # 208.
3. B. Klein, "A Development Approach for Cold Fusion," ICCF5 paper # 613.
4. T. K. Sankaranarayanan et al., "Evidence For Tritium Generation in Self-Heated Nickel Wires Subjected to Hydrogen Gas," ICCF5 paper # 307.
5. M. Srinivasan, "Experiments with Plasma Focus Devices: the Past, Present and Future," ICCF5 paper # 605.
6. L. G. Sapogin, "On One of Energy Generation Mechanism in Unitary Quantum Theory," unnumbered ICCF5 paper.
7. L. G. Sapogin, "On Unitary Quantum Mechanics," *Il Nuovo Cimento*, vol. 53A No. 2, p. 251 (1979).
8. J. Griggs, "Sonoluminescence, Excess Energy and the Hydrosonic Pump," ICCF5 paper # 607.
9. R. George, "Cavitation Induced Micro-Fusion as Evidenced by the Production of Heat, 3He, and 4He," ICCF5 paper # 324.
10. Y. Arata, "Utilization of 'Spillover-Deuterium' in Double Structure (DS) Palladium Cathodes," ICCF5 paper # 601.
11. Y. Iwamura et al., "Characteristic X-Ray and Neutron Emissions from Electrochemically Deuterated Palladium," ICCF5 paper # 312.
12. T. Itoh, "Observations of Nuclear Products Under Vacuum Condition from Deuterated Palladium with High Loading Ratio," ICCF5 paper # 311.
13. K. Shikano, "D_2 Release Process From Deuterated Palladium in a Vacuum," ICCF5 paper # 332.
14. S. Isagawa, "Heat Production and Trial to Detect Nuclear Products from Palladium-Deuterium Electrolysis Cells," ICCF5 paper # 220.
15. T. Claytor, "Tritium Production From a Low Voltage Deuterium Discharge on Palladium and Other Metals," ICCF5 paper # 306.
16. R. Notoya, "Nuclear Products of Cold Fusion Caused by Electrolysis in Alkali Metallic Ions Solutions," ICCF5 paper # 609.
17. R. Bush, "A Demonstrator For The Light Water Excess Heat Effect," ICCF5 paper # 617.
18. J. P. Biberian, "Excess Heat Measurement in $AlLaO_3$ Doped With Deuterium," ICCF5 paper # 205. See also Mizuno, *Proc. ICCF4*.
19. J. DuFour, "Interaction Palladium/Hydrogen Isotopes Cold Fusion By Sparking In Hydrogen Isotopes," ICCF5 paper # 604.
20. I. B. Savvatimova, "Nuclear Reaction Product Registration on the Cathode after Glow Discharge," ICCF5 paper # 318.
21. K. Kunimatsu, "Materials/Surface Aspects of Hydrogen/Deuterium Loading into Pd Cathodes," ICCF5 paper # 501.
22. M. Okamoto, "The Present Status and the Scope of the Japan Basic Research Project of New Hydrogen Energy," ICCF5 paper # 211.
23. S. Pons and M. Fleischmann, "More about Boiling," ICCF5 paper # 204.
24. H. Ikegemi, "The Next Steps In Cold Fusion Research," *Oyou Butsuri*, Vol 62, No. 7, July 1993, p. 717
25. E. Kennel et al., "Gamma and X-Ray Measurements in Electrochemically Active Systems," ICCF5 paper # 330.
26. A. B. Karabut, "Excess Heat Measurements in Glow Discharge Using Flow Calorimeter," ICCF5 paper # 319.
27. M. Eisner, "The Serendipitous Design and Execution of an Early Experiment which confirmed Heat in the Fleischmann-Pons Effect," ICCF5 paper # 212.
28. T. Lautzenhiser, D. Phelps, "Cold Fusion: Report on a Recent Amoco Experiment," Amoco Production Company, Report T-90-E-02, 90081ART0082, 19 March 1990.
29. W. Hansen, "A Statistical Approach to Electrochemical Calorimetric Analysis," ICCF5 paper # 213.
30. M. H. Miles (Naval Air Weapons Center), B. F. Bush (SRI), D. E. Stillwell (CAES), "Calorimetric Principles and Problems in Measurements of Excess Power during Pd-D_2O Electrolysis," *J. Phys. Chem. 1994, 98*, p. 1948-1952.
31. M. Fleischmann, S. Pons, "The Experimenter's Regress," ICCF5 paper # 215.

• ICCF5 Abstract •

MICROANALYSIS OF PALLADIUM CATHODES AFTER ELECTROLYSIS IN ACIDIFIED HEAVY WATER

S. Miguet and J. Dash, Physics Dept., Portland State University, Box 751, Portland, OR 97207.

Previously, we reported finding localized concentrations of unexpected elements on palladium cathodes after electrolysis in an electrolyte containing H_2SO_4 and D_2O (1,2).

Recently, chemical analyses of palladium 0.35 mm thick which was used as a cathode for 25 hours and then inadvertently as an anode for 170 minutes, were performed with an energy dispersive spectrometer attached to a scanning electron microscope.

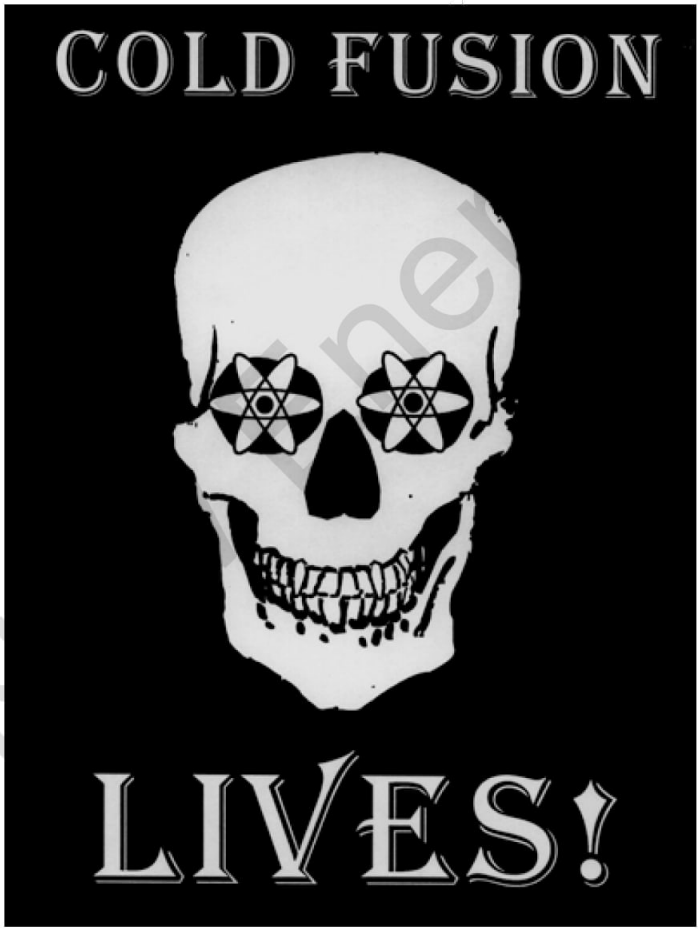
Because of the anodic thinning of the electrode on the lower part in the last experiment, we were able to study the core of the material. Localized concentrations of aluminum and titanium were found at surface protrusions or depressions on the lower part of the palladium where the metal dissolved. It seems unlikely that aluminum and titanium were deposited from impurities in the system because neither element was detected in prior chemical analyses of the electrode materials.

Near the electrolyte level, a black blob with fibers appeared on the anode side of the palladium after the first 10 hours of electrolysis. This surface feature persisted through 15 additionnal hours of electrolysis as a cathode, followed by 170 minutes as an anode, and then by ultrasonic cleaning in deionized water. A series of analyses of the same portion of this feature over a period of several weeks showed that changes were occurring with time. These include growth of palladium sulfate crystals, bulges in the fibers, and the occurrence of silver which appeared to change to cadmium as time progressed.

These results seem consistent with the suggestion of Savvatimova, Kucherov and Karabut (3) that the reason for the appearance of unexpected elements is fusion-fission nuclear reactions in the cathode. This conclusion is supported by our discovery of large, localized concentrations of aluminum and cadmium on an electrolyzed palladium cathode 15 months after localized concentrations of silver were observed near areas where the cathode had melted (2).

References

1. D.S. Silver, J. Dash, and P.S. Keefe, "Surface Topography of a Palladium Cathode After Electrolysis in Heavy Water," *Fusion Technology* **24**, 423 (1993).
2. J. Dash, G. Noble, and D. Diman, "Surface Morphology and Microcomposition of Palladium Cathodes after Electrolysis in Acidified Light and Heavy Water: Correlation with Excess Heat," Trans. *Fusion Technology* **26**, # 4T, 299 (1994).
3. I.B. Savvatimova, Ya R. Kucherov, and A.B. Karabut, "Cathode Material Change after Deuterium Glow Discharge Experiments," ibid 389 (1994).



Cold Fusion Lives! You have to be tough to be a cold fusion supporter, so why not look it? Conceived by a semi-reputable cold fusion scientist and beautifully drawn by artist Robert Paschell, this high quality black T-Shirt shows a grinning silver skull with red atoms in yellow glowing eye sockets. It will be a sign of prestige at either the next American Physical Society meeting or biker convention, depending on your preference. Or, surprise your favorite skeptic with a truly memorable gift (guaranteed to produce excess heat!!).

Mail to:
Al Kemme Associates, PO Box 503,
Yellow Springs, OH 45387-0503
EMAIL: AlKemme@aol.com.

Name_____
Address_____
City, State, Zip_____
Quantity____ Size S____M____L____XL____
Only: $16.00 each plus $1.50 P & H. Ohio residents add $1.00 sales tax.
Check____Money Order____Visa____MC____
Card#_____
Exp. date____Sign_____

Infinite Time Archive

ICCF5 ORGANIZATIONS

This is a list of organizations that were represented by individuals taking part in ICCF5, April 9-13, 1995. Monte Carlo, Monaco [Copyright Akira, Kawasaki, all rights reserved.]

• 21st Century Science & Technology, Washington, DC, USA
• Academia Navalle Gr. Physics. Livorno, Italy
• AGA S.A. (France)
• Aisin AW Co. Ltd., Anjo, Japan
• Aisin Seiki Co., Ltd (Japan)
• American Nuclear Society / Fusion Technology publication
• Amoco Production Company, TX, USA
• Ansaldo Ricerche s.r.l., Genoa, Italy
• Bechtel Power Corp.
• Belarus State University, Minsk, Belarus
• Bhabha Atomic Research Center (BARC), Neutron Physics Division, Bombay, India
• Bhabha Atomic Research Center, Solid State Physics Div., Bombay, India
• Burns Development Ltd., BC, Canada
• California State Polytechnic U., Physics Dept., Pomona, CA USA
• Canon, Inc. Planning Div. Bus. Machines Tech. Strategy, Tokyo, Japan
• Catalysis Research Center, Hokkaido University, Sapporo, Japan
• Ceglec S.A. (France)
• Central Research Institute of Electric Power Industry, (C.R.I.E.P.I). Tokyo, Japan
• CISE s.p.a., Segrate(MI), Italy
• Chevron, USA
• Clean Energy Technologies, Inc., Dallas, TX, USA
• CNAM Laboratoire des Sciences Nucleaires
• CNR IPELP, Padova, Italy
• Coca Cola, Georgia, USA
• Cogema, France
• Cold Fusion Research Advocates, Chamblee, Georgia, USA
• Cold Fusion Technology, Concord, NH, USA
• Cold Fusion Times, Wellesley, MA, USA
• Commissariat a l'Energie Atomique, Cerem Dem Ceng, Grenoble, France
• Conseil Economique Social, Sanofi Bio Industries, Grasse, France
• Cyclotron and RI Center, Tohoku University, Sendai, Japan
• Daneliuk & Page, Ontario, Canada
• Department of Engineering, Hokkaido University, Sapporo, Japan
• Dipartimento di Fisica, and/or Chemistry, U. Roma III U. "La Sapienza," Roma, Italy
• Dipartimento di Fisica, Politecnico di Torino, Italy
• Dipartmento di Fisica, Universita di Milano, Milano, Italy
• Edison House. European Research Center, London, UK
• Edison S.P.A., Centre di Ricerca, Macherio (MI), Italy
• ENEA, Frascati(Roma), Italy
• ENECO, Inc., U. of U. Research Park, Salt Lake City, UT, USA
• Energetic Materials Research and Testing Center, New Mexico Tech., NM, USA
• EPRI (Electric Power Research Institute), Nuclear Power Group, Palo Alto. CA, USA
• E-Quest Sciences, Palo Alto, CA, USA
• Equos Research Co. Ltd. Nagoya, Japan
• European Patent Office, Munich, Germany
• Faculte' des Sciences de Luminy, Dept. de Physique, Marseilles, France
• Fiat Compres, Via Cuneo 21, Torino, Italy
• Framatome -Direction Technique,
• Tour Fiat Courbevoie, France
• Fusion Information Center, Salt Lake City, UT, USA
• Genema, B. M., Toulon,France
• High Scientific Research Laboratory, Tsu City, Japan
• Hydro Dynamics, Inc., Rome, Georgia, USA
• IFAM-CNR, Pisa, Italy |
• IMRA Europe S.A., Sophia Antipolis, France
• IMRA Japan, Japan
• IMRA Material R&D, Kariya, Japan Industrial Tech. Dept, NEDO, Tokyo, Japan
• INFN Lab Nationali de Frascati, Frascati, ITALY
• INFN Sezione di Torino, Laboratorio Technologico, Torino Italy
• INFN Sezione Milano, Milano, Italy
• INFN-Sezione di Torino, Dipt di Fisica Sperimentale, Torino, Italy
• Institut für Astrophysik, Bonn, Germany
• Institute of Applied Energy, Minato-City, Tokyo, Japan
• Institute of Isotopic and Molecular Technology, Cluj-Napoca, Romania
• Institute of Physics, Belgrade
• International Centre for Theoritical Physics, Triest, Italy
• Interspace Research, Inc., British Columbia, Canada
• IPD Associates, GA, USA
• IPELP CNR, Padova, Italy
• ISPESL, Civitavecchia (Roma), Italy
• ISS, Roma, Italy
• Joetsu University of Education, Physics Dept., Niigata, Japan
• John Walker Ltd., West Midlands, UK
• Josephthal & Co., Salt Lake, UT, USA
• Kaliev Enterprises, Santa Rosa, CA, USA
• Kobe University of Mercantile Marine, Dept. of Nuclear Engineering, Kobe, Japan
• Korean Atomic Energy Research Institute, Taejon, Republic of Korea
• Laboratorio di Fisica, Instituto Superiore di Sanita, Roma, Italy
• LEI CNRS, Meudon, France
• Los Alamos National Laboratory, Los Alamos, NM, USA
• MADI Technical University, Physics Dept., Moscow, Russia
• Massachusetts Institute of Technology, Cambridge, MA, USA
• Matsushita-Technoresearch, Inc., Material Characterization Dept., Osaka, Japan
• Mayer Applied Research Inc., MI, USA
• Michigan Technological University, Houghton, Michigan, U.S.A.
• Mitsubishi Heavy Industries Adv. Tech. Research Center., Yokohama, Japan

EIIA

Investment Opportunities in Over Unity Energy Production Systems

Information distributed Free by the EIIA Scientists, Invited to Provide Information For Investors

The Energy Investment Information Association, EIIA, distributes to potential investors information from scientists and research groups seeking investment funds. The EIIA is a non-profit organization and does not charge for its services. The EIIA seeks to promote non-polluting low-cost energy technologies and environmental technologies. If you would like to send or receive information concerning investment opportunities in these areas, please contact:

EIAA
163 S. Lincoln #C
Denver, CO 80209-1929 USA
(303) 777-5664; FAX (303) 722-7505

New Energy Times Archive

• National Institute for Fusion Science, Nagoya, Japan
• National Lab for High Energy Physics, KEK Accelerator Dept., Tsukuba, Japan
• Nat. Acad. of Sciences of Ukraine, Inst. for Nuclear Research, Kijiv, Ukraine
• Naval Postgraduate School, Monterey, CA, USA
• Naval Research Laboratory Code 7252, Washington, DC USA
• Naval Research Laboratory Code 6600 Washington, DC USA
• NAWC -Weapons Division, China Lake, CA, USA
• New Energy and Industrial Technology Development Organization, Japan
• New Hydrogen Energy Laboratory, Inst. of Applied Energy, Sapporo, Japan
• Nippon Telephone & Telegraph (NTT), Basic Res. Laboratories, Atsugi, Japan
• Novolec S.A. (France)
• Nuclear Fuel Ind. Ltd., Osaka,Japan
• Oakton International Corp., Oakton, VA, USA
• Obelisk Plasma Conversion Ltd. Fairbanks, AK., USA
• Ontario Hydro International, Inc., Ontario, Canada
• Orim S.R.L., Macerata, Italy
• Osaka University, Osaka, Japan
• PCS Ltd., Asti, Italy
• Philips Research Laboratories, The Netherlands
• Physical Institute, Russian Academy of Science, Moscow Russia
• Pierre et M. Curie/Paris VI. Lab de Physique Theorique, Paris, France
• PolyTech (USA), Corp., Hawaii, USA
• Portland State University, Physics Dept.
• Proteus, Processes, Technology, Inc., Denver, Co.,USA
• Purdue University, Dept. of Physics, IN, USA |
• Research S stem, Inc., Arlington, VA, USA
• Riber S.A. (France)
• RRC Kurchatov Institute, Moscow, Russia
• Russian Academy of Sciences, Institute of Physical Chemistry, Moscow, Russia
• Scientific Industrial Association, "LUCH", Moscow Region, Russia
• Setaram Groupe sfim, Calure, France
• Shell Research S.A., Laboratoire des Sciences Nucleaires, Paris, France
• Shizuoka University, Department of Physics, Shizuoka, Japan
• Showa Denko K. K., Tokyo, Japan
• Space Exploration Associates, OH, USA
• SRI International, Menlo Park, CA, USA
• Technical Physics & Prototype Engineering Division, BARC
• Technology Research Eng. Co., Kaluga region, Russia
• Technova, Inc., Tokyo, Japan
• Timepoint Corporation, San Francisco, CA, USA
• Tohoku University, Sendai, Japan
• Tokyo Institute of Technology, c/o Okamoto Laboratory, Tokyo, Japan
• Tokyo Institute of Technology, Research Lab. for Nuclear Reactors, Tokyo, Japan
• Tokyo University of Agriculture & Technology, Tokyo, Japan
• Toshiba Power Systems Engineering, Tokyo, Japan
• Universitat Hamburg, I. Inst. Experimental Physics, Hamburg, Germany
• University de Haute Alsace, Mulhouse, France
• Universite' deMarne-la vallee, Paris, France
• Universite de Padova, Physics Dept,, Padova, Italy
• University de Reims, Chezy sue Marne, France
• Universite' Paris France
• University Autonoma, Dpr. Fisica de Materials C IV, Madrid, Spain
• University of Belgrade, Faculty of Physical Chemistry, Belgrade, Yugoslavia
• University of Hawaii at Manoa, Chem. Dept., Honolulu, HI, USA
• University of Hokkaido, Dept. of Nuclear Engineering. Sapporo, Japan
• University of Hong Kong, Hong Kong
• University of Houston Dept. of Physics Houston, TX, USA
• University of Illinois, Fusion Studies, Lab 100 NEL, Urbana, IL, USA
• University of Milano, Department of Physics, Milano, Italy
• University of Milan, Dipt de Scienze dell Inforrnazi, Milano, Italy
• University of Padova, Physics Dept., Padova, Italy
• University of Utah, Physics Dept., Salt Lake City, UT, USA
• Ural Branch of Russian Academy of Science, Ekaterinburg, Russia
• Utah State University, Physics Dept., UT, USA
• Yokogawa Medical Systems, Ltd. Hino, Japan |
• Yokohama National University, Dept. of Energy Eng., Yokohama, Japan
• Yunnan University Dept. of Physics Kunming, China
• ZSW, Germany

Flowing Electrolyte Calorimetry

by Dennis Cravens, ENECO and Vernon Regional Junior College, Vernon, Texas 76384

Abstract

When the specific heat and flow rate of the electrolyte are known, the thermal output of cells using circulating electrolytes can be determined. An independent evaluation of the "Patterson power cell" was conducted using the circulating electrolyte as a heat transfer medium. This allows for real time measurements and alteration of the electrolyte. The cell was found to give measurements consistent with claims of excess power. Suggestions for the improvement of the calorimetry are given, A simplified version of the system was demonstrated during the first three days of the conference and made available to those requesting its examination.

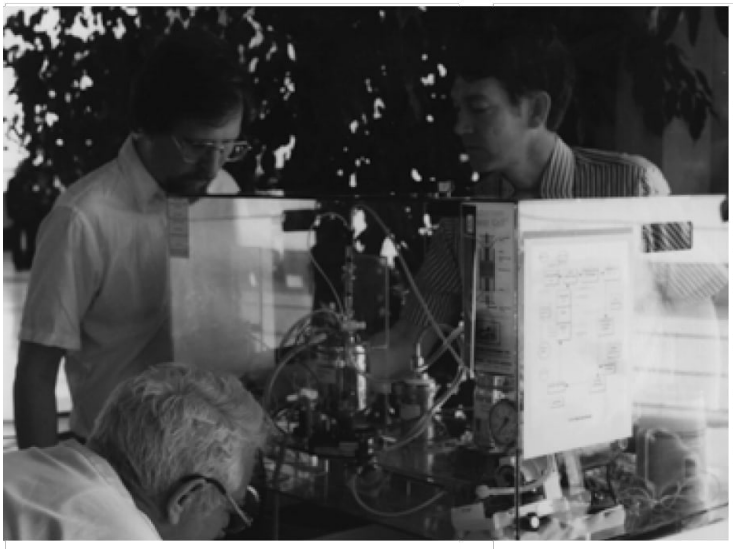
Introduction

The "Patterson Power Cell" [1,2] has been claimed as both a light and heavy water system producing excess heat. Before conclusions can be drawn, however, its unique calorimetry must be investigated. The system uses its electrolyte in a flow calorimetry approach. This allows greater and more rapid adjustment of internal cell conditions. It also permits real time measurements of reaction products. It is one of the few cold fusion systems which has been granted a U.S. patent. The author was requested to evaluate the system for a third party.

The evaluation consisted of three parts- 1) observation of the cell being operated at its original site by its inventor, 2) personally operating this device at its original site [3], and 3) independently reproducing the device at a local site and running it. All of these gave compatible results. This indicates that the device does give the observable measurements as claimed. However, ruling out systematic or equipment errors required redesign of essential components.

The initial design presented to the author used thick plaster of Paris insulation around the cell. The calibration resistor was embedded in the plaster and external to the cell. The overall efficiency, as measured by heat gained by the electrolyte from the resistor,

New Energy Times Archive



(L-R) Jed Rothwell (Cold Fusion Research Advocates), Dr. Talbot Chubb (U.S. Naval Research Laboratory), and Dr. Dennis Cravens (ENECO and Vernon Regional College examine the PPC demonstration calorimeter at ICCF5. *Photo: EFM*

varied from 20 to 70%. Such variability complicates any detailed analysis. The calibration resistor was replaced inside the cell. The cell was wrapped with glass wool, housed inside two Dewar flasks set mouth-to-mouth, and sealed from humidity changes by parafilm. This raised the thermal efficiency of the calorimeter to 86 to 93% —depending on its packing and sealing. This also lowered the thermal mass and shortened its response time. Additional sensors were added so that all measurements could be checked by secondary instruments. An initial quantitative investigation of the cell was begun after these modifications.

Design

The modified cell is diagrammed in Figure 1. The use of plated beads for the cathode is its most unique feature. These beads were supplied by Clean Energy Technologies, Inc. [4]. The beads are based on a cross linked copolymer of styrene divinyl benxene and produced according to published patents [1,2], The small spheres were originally designed for work as density gradient markers for protein analysis which were produced and used according to U.S. patents. The base beads are also used in amino acid analysis and ion exchange systems. The spherical construction of the beads allows for uniform expansion and contraction without the development of large stresses and cracks. Current work [5-7] has indicated that, for at least nickel, normal water systems the cold fusion effects are a surface or near surface effect. Thus the use of many small spheres provides a large surface area without the development of extensive cracking.

The beads are first sulfated with chlorosulfonic acid to provide a conductive surface. The surface of the beads then is fixed with a copper chloride solution. This allows the beads to withstand higher temperatures, while avoiding local hot spots, and allows uniform plating of metals onto their surfaces. The beads are then coated with nickel by chemical deposition. Then the beads are over-coated with palladium. Finally, the beads are again covered with nickel. These multiple layers of nickel/palladium/nickel on beads so far have out-perform single coatings. Others [8] have investigated such multilayer thin films on plates which eventually detached from the surface. The plated beads have performed continuously in cells for over one hundred hours without observable changes. It is estimated that 40 mg of metal (a total of about 2 microns thickness of all layers) and about 1,200 beads are used within the cell. It is important to note that the small amount of metal used should be beneficial for searches of isotopic shifts.

The electrolyte outlet temperature, T2 is measured at the top of the cell as it reaches the height of the lower containment lid. the inlet temperature, Tl, is measured 5 cm from the lid as the electrolyte flows into the cell. The initial designs used thermocouples (K-type) coated with epoxy. After extended runs, it was determined that the lithium ions from the electrolyte were causing "decalibration errors" in the thermocouples. Furthermore, the thermocouples were not completely electrically isolated from the electrolyte. Thus, the electrolytic current could interfere with the temperature measurements.

The thermocouples were moved to stainless steel wells and insulated with teflon tape and heat sink compound. The two stainless steel wells were connected to a common ground. This increased the thermal response time but prevented additional electrical interference. The upper portion of the thermocouple wells were lightly insulated by tygon tubing. It has to be pointed out that the length of the thermocouple well outside the electrolyte may cause the inlet thermocouple to see a weighted average of the temperature between the electrolyte and the environment. Such "wicking effects" have been known to produce errors of 10 to 20% It is recommended that future designs should avoid wells which extend beyond the tubing and should employ thick insulation at

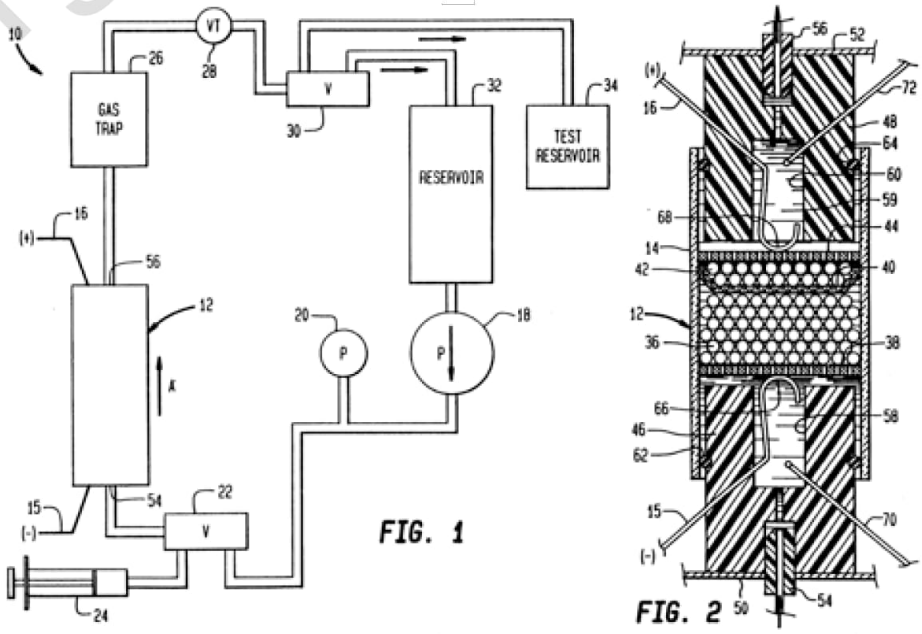


Figure 1-A. Patterson Power Cell cross-section and system diagram from U.S. Patent #5,372,688

New Energy Times Archive

the site of the measurements. In most experimental runs the inlet sensor region was also located within the upper Dewar end within the glass wool insulation. The physical location of the well was in a region of large flow gradients (i.e. cross sectional areas changed from 1 mm2 to 10 mm2 and back to 1 mm2). This provides some mixing. It is recommended that any redesigns use a commercial in-line mixer just up-stream from the temperature sensor.

The overall system is diagrammed in Figure 2. The electrolyte flows in a closed loop 1) from the reservoir 2), to the pump 3), through the flow sensor 4), through the cell 5), to a gas splitter and 6) returns to the reservoir. The input power is calculated from total voltage and current supplied to the cell. The voltage was not corrected for the gas production. The output power was obtained by the heat absorbed by electrolyte flow. The electrolyte is prepared from a one-molar lithium sulfate solution of normal water. The electrolyte also serves as the heat transfer fluid. It has an apparent specific heat of approximately 0.95 within the overall system, The output heat can be arrived at via calibration curves of the cells or from first principles using the specific heat of the electrolyte. In practice, both were used and found to agree within 15%.

Calibration

The system was first calibrated using distilled water for the working solution and the internal calibration resistor for its heat source. This produced overall efficiencies for the calorimeter within the range of 86 to 92%. The exact value is dependent on the sealing method (parafilm or silicon rubber) and the packing of the glass wool. The data sets given later are based on the 88% configuration using parafilm to seal the gaps against air flow. A series of calibration runs were conducted by varying both the flow rate and input power independently. The efficiency was found to be stable (88% +/- 2%) over all practical flow rates or resistor inputs.

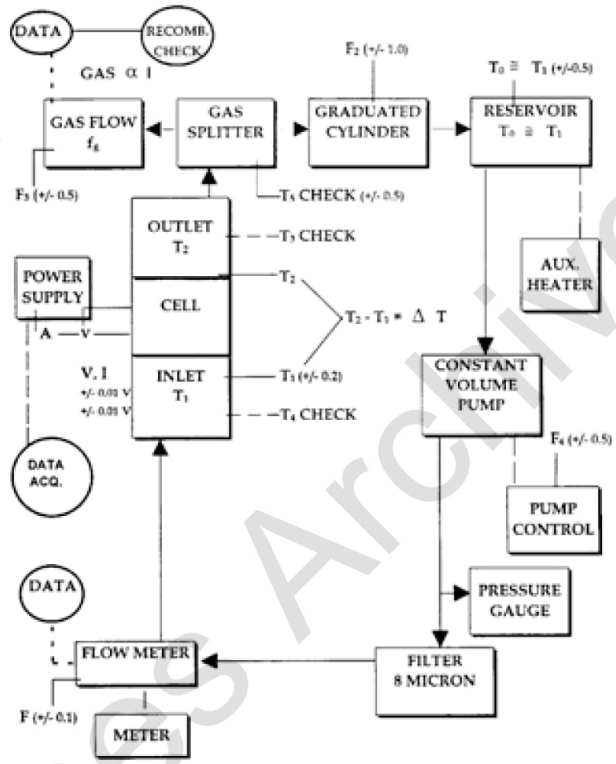


Figure 2. System diagram of Patterson Power Cell calrorimetry system

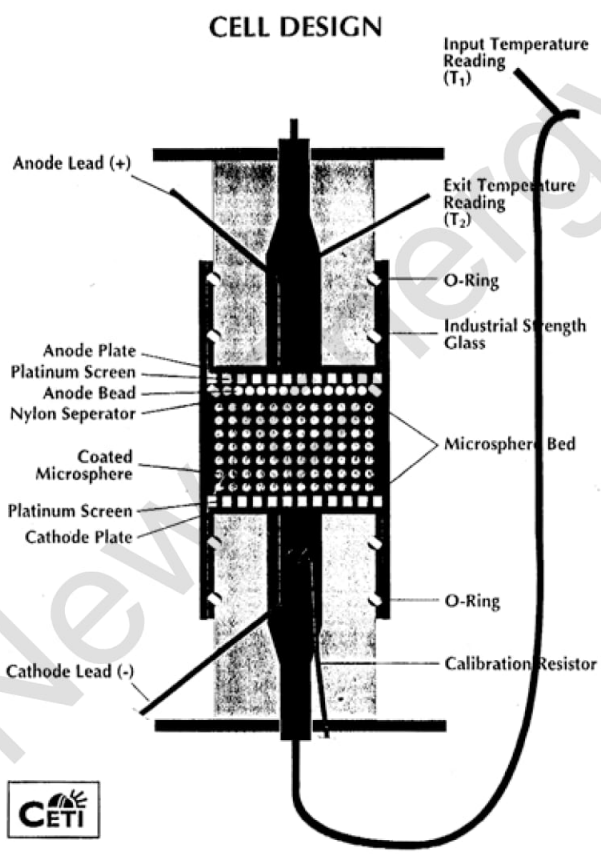


Figure 1-B. Patterson Power Cell deign

Next, the 1 M lithium sulfate electrolyte was used as the working solution. Its apparent specific heat within the unit was approximately 0.95 based on the above water calibration. It should be noticed that lower specific heats of the working fluid could lead to overestimates of the heat generation. However, saturated lithium sulfate solutions are about 3 molar. A 100 ml volume of a saturated solution at the working temperature contains only 88g of water. Thus, the specific heat of the electrolyte should never be lower than about 0.88 .A second calibration series was conducted using the lithium sulfate solution and the calibration resistor.

At the beginning and end of each experimental run, a calibration pulse of 15 minutes was used to check the system's performance. During some runs, a calibration pulse was delivered as the system was generating anomalous heat. In those cases, it was noticed that power delivered to the calibration resistor gave additional heat output greater than can be expected by simple additive processes. This is seen as either: a) the heat producing mechanism has a positive temperature coefficient or b) the instrumentation and sensors over estimate the heat generation. All physical mechanisms proposed (gas bubbles at sensors, heat gain and loss via sensor sheaths, etc.) in support of the second alternative appears to be an order of magnitude smaller than the observed effects. To test the first premise, an auxiliary heater was added to the electrolyte's reservoir. Pre-heating of the electrolyte to 40 to 60 degrees before entry into the cell apparently enhances the power generation. Due to limited time, only a few runs at elevated temperatures were conducted. Further, investigation was clearly indicated and should throw light on the heat mechanism and response of the instruments. Such effects are the subject of current experimentation,

There is an initial loading period required of the beads. This is about 12 hours for fresh beads and only 1 hour for pre-loaded beads. This is

New Energy Times Archive

Patterson Power Cell Demonstration Data Taken at ICCF5

Date	Time	Voltage (V)	Amp (I)	Flow Rate (liters/min)	ΔT°C	Raw Heat Yield (a) (%)	Heat Yield - Correction (b) (%)	Heat Yield Correction (c) (%)
4/9/95	21:10	3.29	0.7	10.28	1.1	343	399	724
4/9/95	9:45	3.8	.12	10.08	2.6	401	466	764
4/10/95	14:38	3.8	.12	10.04	3.5	538	625	1024
4/10/95	14:45	3.8	.12	10.11	3.6	557	648	1061
4/10/95	15:15	3.8	.13	10.01	3.3	467	543	889
4/11/95	12:28	3.74	.15	10.0	2.4	299	347	575
4/11/95	14:05	3.74	.13	10.0	2.5	359	417	691
4/11/95	18:30	3.43	.10	9.375	2.5	477	555	976
4/11/95	18:50	3.43	.09	10.0	2.35	531	618	1087
4/12/95	12:00	4.15	.21	10.0	3.0	240	279	434
4/12/95	14:10	4.15	.21	10.0	3.2	256	298	463
4/12/95	16:20	4.15	.21	10.0	3.4	272	317	492

(a) Raw heat yields without gas or thermal heat loss corrections.
(b) Heat yields with thermal heat loss correction (cell is 86% thermally efficient).
(c) Heat yields with thermal heat loss correction and gas correction (1.48); assuming no recombination.

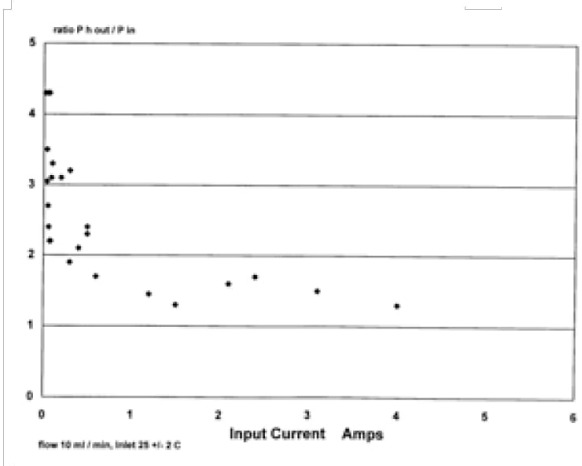


Figure 3. Typical data set from Patterson Power Cell. Power ratio versus input current (amps).

conducted by using a constant current supply set at 0.2 to 0.5 amps. The cell's resistance gradually changes from 135 to 160 ohms. This is thought to be due to hydride production on the surface of the beads. The temperature between the inlet and outlet gradually increases toward the end of the loading period.

Typical data point

There are six primary measurements for each data set: the electrolyte flow, F, the. voltage,V, the current, I, the temperatures of the inlet, T1 and the outlet, T2, and the gas production flow, f. The gas flow is monitored only to verify that no appreciable recombination occurs. This was found to be true to the limits of measurements, +/- 0.5 ml/min . All measurements were taken by two separate sensor systems and found to be internally consistent. All meters, except the temperature, were calibrated and traceable to national standards. The following data set is typical but was taken in a simplified demonstration system at the ICCF5 conference: V = 3.8V, I= 0.12 A, F=10.30 ml/min, T1 =24.3 °C, T2=26.9 °C, f=1.2 ml/min (average), This and similar data sets were witnessed by some ICCF5 participants. This specific data point represents an input power of P=VI =0.46 W. It represents a thermal output of d[mc(T2-T1)]/dt = 1.77 W. The gas production represents an additional power production of 0.18 W. The heat loss from the cell is estimated at an additional 14 % of the heat production or 0.25 W. Such a point would appear as power ratio of 1.77/0.46 - 3.8. Notice that the thermal power production exceeds the electrical input power even without addition of the gas production or heat loss terms.

A series of data sets were taken and the results represented in Figure 3. The points in this figure where taken with the complete laboratory device and under environmentally controlled conditions. The power ratio of power out to power in is in the range of 1 to 5 when neither gas production, or heat loss are added to the output figures. The ratios are slightly higher when those terms are added. It is interesting that the cell gave values of between l and 2 for those ratios at high currents (>1 amps). This is consistent with other studies [9] of nickel-based systems showing a higher power ratios at low currents. At low current (<0.2 amps) there is more scatter in the data. this is because any errors or uncertainties of measurements are exaggerated by the ratio at low

power levels. However, the ratios are consistently above 2 to l even with the most pessimistic data sets. The high current regions of the charts are on firmer experimental grounds. However, it is the low current regions that are the most intriguing for future engineering projects.

During the conference, a simplified version was demonstrated. This used hand meters instead of bench meters, minimum insulation for visibility and other low weight alterations. The demonstration device was displayed and run for three days (minus about three hours due to transport to nightly storage). Power ratios of between 2/1 to 6/1 were demonstrated for most of that time as represented by the typical data set given above. The demonstration was run in the low current ranges (< 0.5 amps). The device was for demonstration purposes only and was designed to illustrate the reproducibility and reliability of the basic design. The goal was to introduce the unique features of this relatively unknown system to conference participants.

Conclusion

The system does appear to be worth further study Nothing discovered during the evaluation of the cell is inconsistent with the production of internal heat within cell assembly provided that there is a positive temperature rate coefficient. This evaluation has concentrated on increasing the thermal efficiency of the calorimeter, consistency between measurements, better placement of the calibration resistor, measurement of gas production in real time , use of calibrated and traceable electrical meters, and alternative measurements of key values. It is advised that further study is required to limit uncertainties due to temperature mea-

New Energy Times Archive

surements of liquid flow. Additional independent experimentation with "inert beads" as controls and the use of in-line mixers should ba considered. The high power ratios at the low current levels need to be revisited using measurements with tighter error bounds. However, regardless of the cause, the system doss give repeatable results at substantial levels. If, as expected, the power levels persist with tighter experimental bounds in the low current levels, then the system should have important practical and commercial application.

References

[1l Patterson, James, "Method for Electrolysis of Water to form Metal Hydride," U.S. Patent 5,318,675.[2] Patterson, James, " System for Electrolysis of Water," U.S. Patent 6,372,688.

[3] Klein, Bruce, "Cold Fusion Testing at Clean Energy Technologies, Inc.," *Infinite Energy*, Vol.1., No.1, March/April 1995, pp.18-21; *"Cold Fusion,"* Vol.9 (1995), p.21.

[4] Clean Energy Technologies, Inc., beads batch # 116 Ni/Pd/Ni. 14332 Monfort, Suite 6302, Dallas, Texas 75240.

[5} Bush, R.T. and R.O. Eagleton, "Calorimetric Studies for Several Light Water Electrolytic Cells With Nickel Fibrex Cathodes and Electrolytes with Alkali Salts of Potassium, Rubidium and Cesium, " *Proc. ICCF4*, 1993, EPRI TR-104188-V2 (1994), p.13.

[6] Notoya, R. and M. Enyo, "

[7] Mills,R. and S.P, Kneizys, "

[8] Miley, G.H., H. Hora, E.G. Batyrbekov, and R.L. Zich, "Electrolytic Cell with Multilayer Thin-film Electrodes," *Fusion Technology*, 26 (1994),p.313.

[9] Ramamurthy, H., M. Srinivasan, U.K. Mukherjee, and P. Adibabu, "Further Studies on Excess Heat Generation in Ni-H_2O Electrolytic Cells," *Proc. ICCF4*, (1993) Vol.2, p.15-1.

IDEA:

Donate a subscription to *Infinite Energy* to your local library.

Comments on Flowing Electrolyte Calorimetry

by Jed Rothwell

How to Do Cold Fusion Experiments Right...

Dennis Cravens is widely acknowledged as one of the best cold fusion scientists. When he talked about his palladium experiments at the Fourth International Conference on Cold Fusion (ICCF4) on Maui, he was met with warm applause, appreciation and congratulations, and many questions. His wry comments and the charming photographs of his garage laboratory and his "CF Rocket Test" evoked laughter, appreciation and applause. Fleischmann voted his paper "most outstanding of the conference" and Tom Passel of EPRI cited him in the introduction to the *Proceedings*. A few months later he was featured in a front page article in the *Wall Street Journal*. So, when Clean Energy Technologies, Inc. (CETI) went looking for a top-notch scientist to verify their experiment, it is not surprising they selected Cravens.

CETI and Cravens went all the way. Not only did they do a superb experiment in the laboratory, but they bravely packed up a portable version of their calorimeter, brought it to the Fifth International Conference (ICCF5), and ran the experiment continuously for three days in the meeting hall lobby, in full view of the scientists there! They allowed people to observe the equipment close-up, and to measure the power levels, temperatures and other parameters with their own instruments. I installed one of my old thermistor probes in the electrolyte reservoir. They exhibited old, used cells and cathode material. They allowed people to take apart the used cells. (I took one apart completely: I accidentally dropped it on the floor and smashed it.)

Most cold fusion experiments are delicate and unpredictable. Excess heat may not turn on for days, and when it does, it usually begins and ends at some odd hour in the middle of the night, when the chart recorder has run out of paper and the computer is down. The excess heat is likely to fade away when you move a cell, or expose it to cool air, or when you the leave the room to get a cup of coffee and to call in a colleague from down the hall to see it. With most cells, the heat is barely detectable. Compared to previous types, the CETI cell is incredibly robust and forgiving. During the conference, the excess heat turned on every morning, 10 or 20 minutes after electrolysis began. It produced a large Delta-T temperature, big enough to detect easily with any type of thermometer. The cell was subjected to abuse that would kill the reaction in other experiments. For example, Cravens lifted the cell out of the Dewar and held it up to show it members of the audience.

The experimental setup fits the personality of the cell. It is also robust, dependable, solid. It is a professional job. It inspires confidence: the parts fit together neatly and snugly; the solder connections are good; the hoses are the right length; the instrument lead wires are bundled and tie-wrapped neatly; the equipment is clean; the electrolyte crystal clear. Instruments and components are labeled; calibration certificates and manuals for the instruments are neatly arranged in a three-ring binder. When a conference attendee asked a technical question about an instrument like the precision flowmeter, Cravens would reach for the notebook, open the manufacturer's manual, and find the answer at his fingertips. This may not sound important, but it is. Most experimental errors are caused by sloppiness: things like loose wires; jumbled equipment; lost equipment manuals; long, leaky plastic tubes filled with bubbles and kinks; old, beat up instruments with no record having been calibrated for years; and dirt. Some of the early, unsuccessful cold fusion experiments were appallingly dirty. Years ago, a well-known scientist sent a post-experiment closed-cell to be analyzed by a friend of mine, who found animal hairs and a dead fly in the electrolyte! Electrochemical cells can be wrecked by minute levels of contaminants. At this stage, it is not known what kinds of contaminants are particularly harmful to a cold fusion reaction, so you must guard against all contamination.

A solid experiment is a simple one. If sloppiness causes most error, unnecessary complexity causes the rest. Cravens believes in the "KISS" rule: Keep It Simple, Stupid! He uses easy, direct methods rather than sophisticated, ultra precise ones. He does reality checks—simple tests based upon first principles. Cravens does use electronic thermometers to measure temperatures to two decimal places and record them on a computer, but he checks them against mercury thermometers, because mercury thermometers are not affected by electronic noise, weak batteries, or software glitches. Very little can go wrong with one; problems like a bubble in the mercury can be seen with the

New Energy Times Archive

Subscribe to 21st CENTURY SCIENCE & TECHNOLOGY

The magazine that brings you tomorrow's technologies today.

U.S. and Canada
Foreign Airmail
$20 for 4 issues (1 year)
$40 for 4 issues (1 year)
$38 for 8 issues (2 years)
$78 for 8 issues (2 years)

Send check or money order (U.S. currency only) to:

21st Century, Dept. IE, P.O. Box 16285, Washington, D.C. 20041

Your **ad could be in this space. Call or write to Cold Fusion Technology for ad rate information....NOW!**

Cold Fusion Technology
P.O. Box 2816
Concord, NH 03302-2816

Phone: 603-228-4516
Fax: 603-224-5975

naked eye. Like any thermometers, they are easily calibrated by putting them in ice slurry (which registers just above 0°C) and in boiling water (just at or below 100°C, depending on altitude). CETI reported Delta-T temperatures during the conference ranging from 1.1°C up to 3.6°C, and I observed temperatures as high as 4°C. Any type of thermometer can measure such large differences with confidence. Finicky, computerized electronic thermometers do not significantly improve the signal-to-noise ratio with such large temperature differences. They do not make the results "even more certain." They make them less certain, because you cannot be sure they are working correctly. An experiment should never depend upon computers unless there is no alternative. Computers should only be used to record data after more direct, simpler tools have proved the data is accurate.

Simple, old-fashioned instruments are relatively crude. They are accurate but not precise; the data points are positioned correctly but error bars are large. With electronic instruments, it is possible to measure 1 or 2 watts with 0.1% precision. You can spot 50 milliwatts of excess heat in a 10 minute burst. But the instruments are so complicated that no one will believe you actually measured 50 milliwatts. Skeptics will argue that some transient glitch may have affected the instruments, and they might be right. The high precision weakens your argument. It works against you. Thousands of stray factors might create such a tiny burst of heat: a person's hand or a beam of sunlight might heat the cell; air currents from heating or air-conditioning equipment produces temperature differences of a few tenths of a degree; electronic noise from things like overhead lights might fool the thermocouples and create the illusion of 50 milliwatts of excess heat. There are thousands of ways to make such a small error. Large, prolonged excess heat effects cannot come from stray background noise or equipment glitches. With old-fashioned instruments, you may only be able to measure to within 5 or 10%, particularly at the low end of the scale. You cannot even see small effects, you are forced to look for much bigger excess heat that remains steady for hours or days. Insensitive equipment forces you to do a better experiment and search for better results. Cravens considers it an advantage that he cannot see 5% excess heat, because he considers such small results distracting and unimportant. The purpose of this research is to create steady, reliable commercially useful levels of excess heat, not tiny transient milliwatt-level bursts.

Some scientists say we must continue to investigate the low level effects and develop a theory to explain them before scaling up. CETI and Cravens, E-Quest and other researchers have proved this is not true. We already know how to scale up. There is no point in looking for small effects now that methods of getting large effects with 100% reproducibility have been developed. Even a scientist whose only goal is to develop a theory should use the CETI cell, or some equally high-powered, equally reliable device, like the E-Quest machines. Suppose your goal is to measure nuclear products like helium. The mass of the nuclear products would be proportional to the energy if the reaction is nuclear, so your job is much easier with a large, steady reaction. The E-Quest device produces thousands of times more energy than the small palladium heavy water electrolysis cells. Therefore, it produces thousands of times more helium, which makes the helium much easy to detect. Scientists working with traditional electrochemical cells struggle to detect a few parts per billion of helium, whereas E-Quest has found 552 parts per million, a hundred times more than the natural atmospheric concentration.1

Suspenders and a Belt

In a good experiment, redundant instruments and different methods are used to measure critical parameters. This is called "suspenders and a belt" methodology. Cravens is a staunch advocate of this approach. Every parameter in this experiment is measured with at least two and sometimes three different, independent instruments. In some cases these instruments work according to different physical principles. This ensures that the instruments will not be affected by noise in the same way to the same extent. Suppose you have two identical thermistors, both with new batteries, placed exactly the same distance away from the cell. Electronic noise might conceivably cause an artifact in both, raising the indicated temperature by 4°C. This is highly unlikely, because noise, by its very nature, affects instruments randomly, inconsistently, causing one to go up and another to go down. But it is at least conceivable that two identical instruments would show the same effect from noise. However, that same noise could not affect a thermocouple to precisely the same extent it affects a thermistor, because they work according to different physical princi-

ples. (A thermocouple is a passive bimetallic thermoelectric device; a thermistor is a resistor which consumes power from an external battery). Furthermore, the electronic noise cannot affect a mercury thermometer at all. Therefore, when Cravens uses pairs of thermistors, thermocouples and mercury thermometers at the same time, and all three register a large temperature increase, you can be sure the increase is not an artifact.

The key parameters in this experiment are measured with redundant instruments. The flow rate, which is usually 10 ml/minute, is measured by three methods:

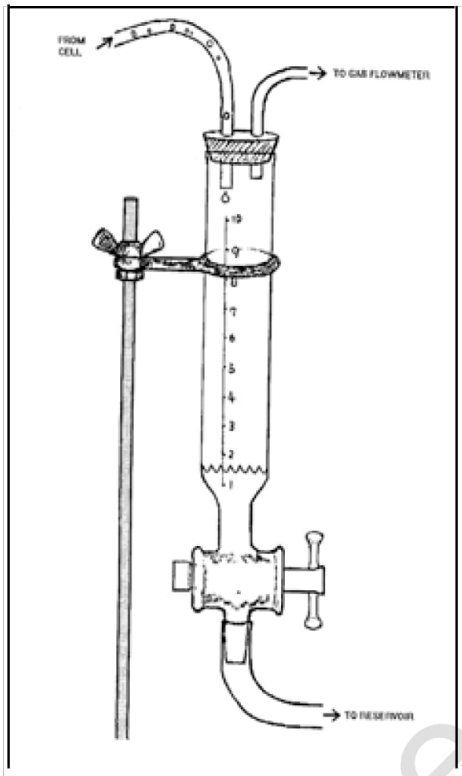
1. With a precision liquid flowmeter.

2. Manually, with a stopwatch. A mixture of liquid and effluent gas from the cell flows into a graduated cylinder marked in milliliters. (See illustration.) This acts as a gas separator, but it doubles as a flowmeter. You can close a stopcock under the cylinder and count how many seconds it takes the column of water to rise 5 ml. (30 seconds at 10 ml/min).

3. With the gas flowmeter attached to the graduated cylinder. Normally, as the liquid electrolyte falls to the bottom of the cylinder, the effluent gas goes out the small plastic tube out the top, through a gas flowmeter, and into the air. The gas flowmeter normally registers a fraction of a milliliter per minute. When you close the stopcock and the water rises, it displaces the gas in the headspace on top, and pushes it out through the gas flowmeter. The gas flowmeter readings jump up 10 ml/min while the stopcock is closed.

The liquid flowmeter gives a precise answer to the nearest 0.02 ml/min (a 0.2% error). The stopwatch method is crude, because a person watching water rise past a mark in a test tube for 30 seconds might be off by as much as one second (a 3.3% error). It is crude but reassuring. It lets you double check the flowmeter with your own eyes.

As mentioned above, temperature is measured with thermocouples, thermistors, and in some tests, with mercury thermometers as well. One mercury thermometer is placed in the reservoir to read the input temperature, and another is placed in the graduated cylinder to read output. During this test, the hose between the cell and graduated cylinder is insulated, to keep the circulating electrolyte from cooling down too much. The liquid does cool somewhat by the time it reaches the cylinder, as expected. The mercury thermometer reads about a degree lower than the thermocouple, which is close to the cell outlet.



Dr. Cravens' graduated liquid flow meter provides complete "reality check."

Input power is measured with bench meters, hand held meters, and it is indicated on the analog meters built into the power supplies. The power supplies are high-precision units certified to meet NIST standards.

Many Calibration Methods

The key to a convincing experiment is careful calibration before, during, and after the experimental run. A nice, straight calibration curve proves the calorimeter is working correctly.

Before the run, data points across the entire range of expected outputs should be taken. If you expect the total power from the cell (input plus excess) might go as high as 2 watts, you should calibrate from 0.5 watts up to 5 or 10 watts, with 8 or 10 points. Each data point represents several hours of data, so 10 data points take a week to gather. In a cold fusion experiment, it is essential to calibrate with both a joule heater and with electrolysis, using some cathode material that has never been known to produce excess heat. CETI uses gold plated beads for this purpose.

During the run, a heat pulse of several hours duration should be added from the joule heater from time to time, just to be sure the temperature rises the expected amount. This is called "recalibrating on the fly." Cravens notes that this heat may enhance the reaction, so the temperature might rise even more than it is expected to, confusing the issue. Others have noted that heat promotes the effect, notably Fleischmann (2), Ikegami (2), and particularly McKubre, who described a 368 kJ burst of excess heat triggered when the cell was heated up accidentally (2).

After the run, a pulse from the joule heater will verify that the equipment is still working correctly.

Cravens calibrated thoroughly in the laboratory. During the demonstration at ICCF5, he did not have time for extensive calibration or calibration on the fly, but the calorimeter was carefully "wrung out" before the conference. Some cold fusion scientists are content to calibrate with only a joule heater at several power levels. Others try to calibrate with electrolysis as well. Cravens goes further: he calibrates at different liquid flow rates, and he plots the effluent gas flow rate against current. Sometimes at very low flow rates stream lines and dead spots in the hose can develop. Calibrating at different flow rates is a good idea. It is not often done. Cravens calibrated at 12 settings between 2 ml/min and 17 ml/min, then he ran at 10 ml per minute, so he tested well above and well below the setting he actually used in the experiment. He checks current (amperage) to be sure the gas flow is at the level predicted by Faraday's law. This ensures that there is no significant recombination in the cell.

Overall, the calibration in the laboratory version of this experiment is much better than most experiments in the literature. The demonstration run during ICCF5 did not allow enough time to do a complete calibration after the equipment was set up. Fortunately, with flow calorimetry, that is not such a critical issue.

Some Doubts Put to Rest

It is a fashion among scientists to express doubts and hesitation about a result even when there is no reason to feel doubt. It seems to be a polite convention to suggest "ways to improve my experiment" even when the experiment is already good enough for any practical purpose. I regard this as gilding the lily. If the experiment proves the point, it is time to move on to the next experiment.

Cravens warns that the fluid in the tubes may not be properly mixed when it reaches the thermocouples:

> "The physical location of the well was in a region of large flow gradi-

New Energy Times Archive

ents (i.e., cross sectional areas changed from 1 mm^2 to 10 mm^2 and back to 1 mm^2). This provides some mixing. It is recommended that any redesigns use a commercial in-line-mixer just up-stream from the temperature sensor."

This is a good example of an exaggerated concern. Mixing is not an issue with this cell, although it can be with other cells. If a stream of fluid is not mixed, it can sometimes separate into layers of cooler and hotter steam lines of water. A small thermocouple probe that does not extend deeply into the fluid might be covered with a stream of warm water while a millimeter away from it, in another steam line, the water temperature is measurably cooler. This problem is more likely to occur with cold water, at around 10°C, than at room temperature or above. To avoid problems like this, people run the water through mixers. McKubre has used a Venturi (a constriction) just downstream from the thermocouple probes for this purpose.(3) This is the same method Cravens refers to here, with large flow gradients. In other cell configurations McKubre uses "glass beads for mixing stream lines." (4) A chamber in section of the pipe just above the thermocouple probes is filled with little glass beads. The water is mixed as it flows through the glass beads. This, of course, is exactly what happens inside the CETI cells, which is also filled with beads. The CETI cell happens to be a perfect design for a fluid mixer. It incorporates both methods of mixing used by McKubre, whereas McKubre's own cells employ only one method. The water cooling water in the CETI cell is also the electrolyte. The bubbles and joule heating from electrolysis can be relied upon to mix it. (With the McKubre cell, the cooling water is separated from the electrolyte.) Furthermore, as noted above, in some tests a mercury thermometer is placed in the gas separation graduated cylinder. The electrolyte comes out of a tube and trickles down the side of the cylinder, splashing into a pool at the bottom, where the tip of the thermometer is located. Surely that must mix it well! The input stream is not mixed, but it is the same temperature as the reservoir, to within a fraction of a degree.

To summarize, mixing in the CETI cell is insured by four different methods: a Venturi; a bead mixer; electrolysis mixing; and splashing the water 6 cm down a graduated cylinder. Adding an in-line-mixer on top of all of these methods would be overkill, even by my standards. "Suspenders and a belt" are all very well, but you do not need to wear two pairs of suspenders and three belts.

Look closely at the other doubts raised by Cravens about his own work, and you see that most are reasons to believe there is more excess heat, not less. His protocols and methods of computing excess heat always err on the conservative side. Any mistake will reduce the estimate of excess heat, rather than adding to it. He says, for example: "It has to be pointed out that the length of the thermocouple well outside the electrolyte may cause the inlet thermocouples to see a weighted average of the temperature between the electrolyte and the environment. Such "wicking effects" have been known to produce errors of 10 to 20%." This would only be a serious problem if: 1.The input electrolyte was considerably warmer than the environment; and 2.The input sensor extended outside the stream but the output sensor did not. Neither is the case with the CETI cell. If the "wicking effect" takes place at all, it will lower the estimate of excess heat.

An Important Public Demonstration

CETI has the right approach to marketing cold fusion. Public demonstrations of working cold fusion devices are essential. Experiments will not convince the scientific establishment. We must have demonstrations and commercial sales of cold fusion heaters and generators. Some corporations feel they must keep their experiments secret. IMRA has not revealed any new data since 1992. Perhaps CETI can reveal more because they have been granted three U.S. patents, whereas IMRA has not yet been granted a patent. Although it sponsored ICCF5, IMRA did not invite conference attendees to visit their laboratory. CETI took the extreme opposite approach. In effect, they brought their laboratory to the conference, and gave every attendee a chance to observe a cell produce massive excess energy. Any attendee was allowed to take readings with his or her own instruments! I have never seen such openness. I think that CETI's approach is much more likely to lead to commercial success than IMRA's. Other high-tech companies in fields like semiconductors, computers, and medical equipment generally follow CETI's tactic of allowing a close-up "show and tell" demonstration of upcoming products. This is usually done at trade shows.

I think the best way to improve the state of the art and to advance a company's commercial prospects is to get the product out in the open where potential customers can size it up. Potential competitors can also size it up, but customers are more important than competitors, and they outnumber competitors by a wide margin. It is foolish to alienate a hundred potential customers, or confuse them, or ignore them, just because you are afraid of one or two competitors.

Perhaps the customs of the physics conference are not those of the trade show. Manufacturers at a trade show are open, willing to share information, eager to demonstrate products. Whereas it seems to me that at physics conferences scientists try to ferret out details of other people's work while revealing as little as possible about their own experiments. Science could use a strong dose of the candid, open exchange of information common in industry. It seems to me there is a romantic myth about academic science, in which scientists work together openly, sharing data, pooling experience. In reality they tend to be bitter rivals. They are often obsessed with priority—being first. In industry being first is not usually so important, since products all tend to go in one direction or with one trend anyway. You are first one year and second the next, and everyone can see where the market is moving, so upcoming improvements are usually common knowledge. I think that the pace of progress in cold fusion would pick up tremendously if the physicists would learn to act more like businessmen and engineers. Some people disagree with me about this issue. Martin Fleischmann's opinion is the exactly the opposite of mine. At ICCF5, he told me he thinks scientists tend to be more open than corporations. That has not been my experience, but perhaps customs vary from one industry to another. Perhaps some industries are more secretive than the ones I have been involved with over the years.

Actually, this is not the first public demonstration of a working cold fusion device. In 1992, at ICCF3, Dr. Reiko Notoya demonstrated a light water nickel cold fusion cell. (5) It was shown in a test tube side-by-side with another test tube containing a nichrome joule heater. The joule heater was set for the same power level after adjusting for expected losses to electrolysis. Temperature was shown on small red alcohol thermometers. When the adjustment for electrolysis was made, the cell containing the nickel cathode was much hotter than the control cell. When both cells were set to the same power level,

New Energy Times Archive

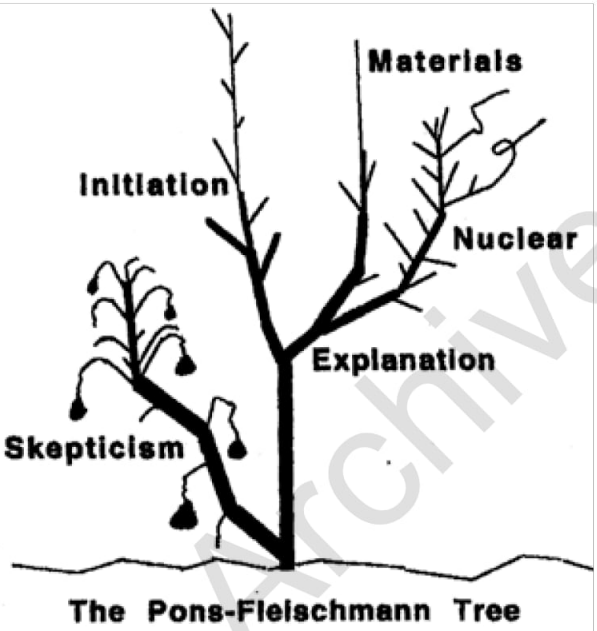
disregarding electrolysis, the temperatures were close. Thus, if total recombination was occurring, the excess heat would have been questionable. There was not total recombination; the bubbles of gas could be seen escaping from the liquid. Still, this was a crude setup. A static calorimeter is not convincing without extensive calibrations and a gas flowmeter to check for recombination. During the conference the cells were run in open air, subject to many random fluctuations and disturbances. Notoya's laboratory experiment was much more convincing. She employed an enclosed, high-precision, air cooled Coolnicks calorimeter and she plotted many data points in the calibration curve. The demonstration at the conference gave people a chance to look at the cells, but it was never intended to be a convincing experiment in and of itself. Unfortunately, her cathodes are finicky and she was not able to repeat the high excess heat results in the laboratory, or to repeat the demonstration in a convincing fashion at other locations. CETI and others subsequently replicated excess heat with nickel and light water, so there is no doubt that Mills (6,7), Bush (8), Notoya and the others who first reported it were correct.

The CETI demonstration was better than the Notoya demonstration because it employed a flow calorimeter, and more elaborate instrumentation. While I am in favor of keeping experiments as simple as possible, the Notoya demonstration was a little too simple. Flow calorimeters have some inherent advantages over static calorimeters. They work according to first principles, so they are less dependent upon calibration. A first principle analysis of a static calorimeter can be done by an expert, and an analysis based the readily observable cooling curves is possible, but these methods take a lot of difficult physics.

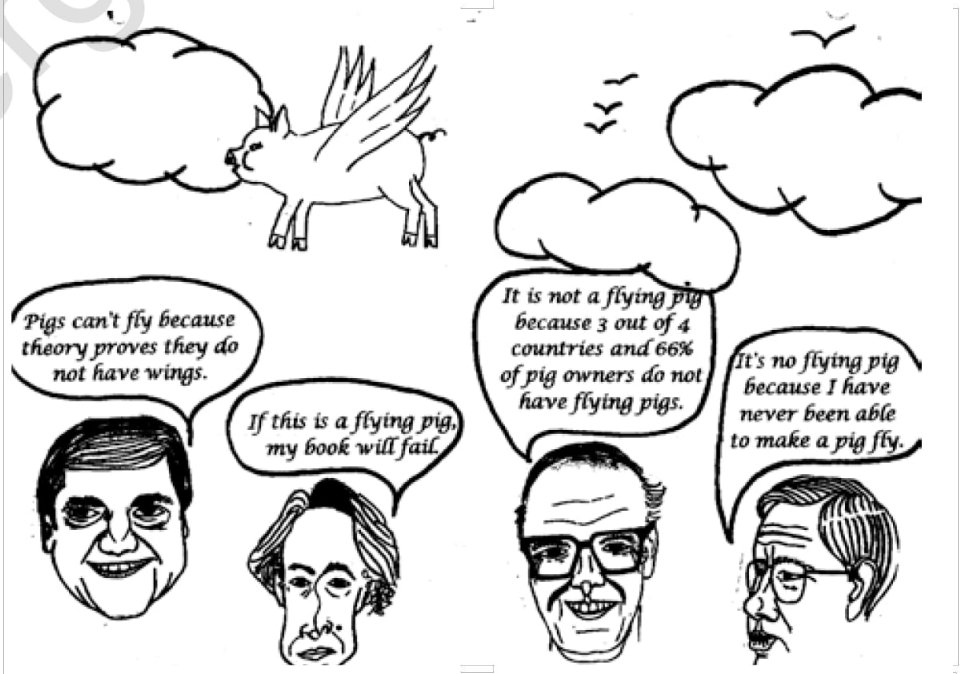
The Notoya demonstration was nowhere near as convincing as a run-of-the-mill laboratory experiment, whereas the Cravens CETI demonstration was more convincing than most laboratory experiments. The instrumentation was better, the layout was superb, and redundant instruments ensured that the effect could not be caused by an artifact. Most important, the CETI cell is so hot, it makes the heat easy to demonstrate. It has a much better signal to noise ratio than most cells, because output is so much larger than input.

References

1. R. George, R. Stringham, "Cavitation Induced Micro-Fusion as Evidenced by the Production of Heat, ^{3}He and ^{4}He," *Proc. Fifth International Conference on Cold Fusion*, Monte-Carlo, Monaco, April 9-13, 1995. Paper 324.
2. M. McKubre, "Loading Calorimetric and Nuclear Investigation of the D/Pd System," *Proc. Fourth International Conference on Cold Fusion*, Hahaina, Maui, Dec. 6-9, 1993. EPRI TR-104188-V1 (1994). paper 5, p. 23.
3. M. McKubre et al., "Excess Power Observations in Electrochemical Studies of the D/Pd System; the Influence of Loading," *Frontiers of Cold Fusion; Proc. 3rd Int. Conf. Cold Fusion, Nagoya, 1992,* ed. H. Ikegami (Universal Academy Press, Tokyo, 1993), p. 10, Fig. 2.
4. M. McKubre et al., "Isothermal flow calorimetric investigations of the D/Pd and H/Pd systems," *J. Electroanal. Chem.* 368 (1994) 55.
5. R. Notoya, "Excess Heat Production in Electrolysis of Potassium Carbonate Solution with Nickel Electrodes," *Frontiers of Cold Fusion; Proc. 3rd Int. Conf. Cold Fusion, Nagoya, 1992,* ed. H. Ikegami (Universal Academy Press, Tokyo, 1993), p. 421.
6. R. L. Mills, S. Kneizys, "Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion," *Fusion Technology,* vol. 20, no. 1, Aug. 1991, pp 65-81.
7 R. L. Mills, W. Good, R. Shaubach, "Dihydrino Molecule Identification," *Fusion Technology,* vol. 25, Jan. 1994, pp 103-119.
8. R. T. Bush, "A Light Water Excess Heat Reaction Suggests that `Cold Fusion' May be `Alkali-hydrogen Fusion'," *Fusion Technology*, vol. 22, no. 2, Sep. 1992, pp 301-322.



Schematic presented by Dr. Edmund Storms at ICCF5



Cartoon Presented by Dr. Edmumd Storms at ICCF5
(L-R) John Huizenga (DOE), Gary Taubes, Douglas Morrison (CERN), Steve Jones (BYU)

New Energy Times Archive

A notable talk at ICCF5....

A Development Approach for Cold Fusion

by Bruce Klein

Abstract: A plan is presented for the investigation and development of the cold fusion effect, ultimately leading to implementation of commercial devices. The plan represents a methodical approach for identifying and addressing theoretical, scientific, engineering, and economic concerns. The plan is presented from the perspective of a large architect/engineering corporation which performs work in established energy industries and which is not currently involved in cold fusion. The plan consists of a number of phases designed to establish the corporation's level and method of involvement in the field. The phased plan provides a number of decision points; at each decision point a commitment to a higher level of funding is made on the basis of additional information which has been generated by the plan to that point. In this way, the corporation can control its financial outlay, yet funding is appropriate so that pursuit of the plan is not hampered.

1. Introduction and Premise

Successful development of commercial cold fusion devices has the potential to substantially impact a corporation that is presently involved in traditional energy markets. This impact could be negative, if the corporation ignores cold fusion developments and finds itself reacting to fundamental changes in its market. Energy companies have already been buffeted in the United States by deregulation of the electric utility industry, a declining market for new energy production facilities, and falling prices for new construction due to intense competition. The impact of cold fusion could be much greater.

The impact could also be very positive, if the energy company were to position itself properly for future developments. This requires involvement early (i.e. now) to assist in the development of the technology, to establish what a profitable future corporate position is, and to prepare accordingly. This paper presents a plan for an energy company to do these things.

There are two premises upon which this paper is based. The first is that the cold fusion effect in its various forms is real. There exists sufficient experimental evidence at this time that this issue no longer needs to be addressed. It is not justified to devote additional resources to demonstrate the existence of the effect.

The second premise is that it is not in the company's interest to try to develop cold fusion by itself, without cooperation from others who are already working in the field. Commercial cold fusion will come to fruition more quickly if cooperative arrangements can be made with those who are knowledgeable in the field, and if joint ventures are established with individuals and companies that have the requisite expertise.

2. Background

It is well known that the involvement by large corporations in cold fusion research and development is very limited. Nevertheless, there are a variety of strong reasons for an established energy company to become involved with cold fusion at this time. These reasons are all economical, and deal both with current market conditions as well as those which may come to pass in the future. The discussion which follows is presented from the viewpoint of an architect/engineering (A/E) corporation.

In general, an A/E does not build hardware, such as boilers, pumps, or electronic control systems. An A/E specifies the requirements for these components and designs their interconnection (civil foundations, piping, cabling, and electrical distribution, etc.). In short, an A/E does all the design and engineering work required to assemble the many thousands of different components that make up a power plant or other large industrial facility. In general the A/E will purchase all the equipment and will oversee the manufacture of this equipment by its vendors. Finally, the A/E will construct the facility or will provide construction management.

From the perspective of the energy-related A/E, energy use can be broadly classified into four categories. The type of work the A/E performs in each area, and the changes which could occur to the respective markets are discussed below.

Bruce Klein is a Project Engineer at Bechtel Power Corporation where he manages large, complex engineering projects.

a. Electricity generation and consumption

In support of electricity generation and consumption, a typical A/E designs power plants, mining, and fuel processing facilities, waste disposal facilities, and environmental remediation projects. The economics of cold fusion electric power generation devices may dictate that they are large-scale facilities like the central generating stations that exist today. This would support a traditional A/E role of system integration and construction.

On the other hand, economics may indicate that the preferable method of implementation is smaller-scale devices either located in neighborhoods or individual homes and businesses. This would disrupt the traditional A/E involvement in this market and would suggest that a different, non-traditional approach is necessary.

In either case, if cold fusion power generating devices are developed and if they are economically attractive in comparison with other methods of electricity generation, an energy-related company would want to be involved in a positive manner. This industry is ferociously competitive around the world. There is an oversupply of engineering and production capacity for producing power plants; establishing a competitive advantage is essential for a company's survival.

b. Propulsion (internal combustion engines, gas turbines, etc.)

An energy-related A/E is typically involved in projects required to produce and process fuel for propulsion. For almost all propulsion the fuel is petroleum, and example projects would consist of oil production facilities, refineries, and pipelines.

If cold fusion devices can be developed that are sufficiently compact and powerful that they can economically replace the internal combustion engine, petroleum use will drop precipitously. Existing industrial capacity will be sufficient to supply chemical, lubrication and plastics use of petroleum for the foreseeable future. The market for large facilities in this energy sector may virtually disappear. This suggests that a substantially different approach would be required by an A/E interested in staying involved in this market.

c. Industrial uses

Industrial energy use typically consists of electricity and heat. Often these are supplied by fossil-fueled power plants which produce steam; some of the steam is used for heating purposes and some of the steam is used to generate electricity. A typical A/E role is to design and construct the steam and electric generation plants. The same changes which cold fusion devices will make to electric power production will occur to industrial energy facilities.

d. Home use (heating, air conditioning, and electrical loads)

A/E's are typically not involved directly in this area. Instead the involvement is with the industrial base required to supply energy to the home. Again, this consists of electricity, petroleum, and natural gas. If self-contained home heating and/or generating units are developed, the need for external energy supply to the home will decrease. The impact on the industrial energy supply structure is obvious.

An A/E would have to adopt a very non-traditional posture to continue to generate revenue from this energy market sector.

So, the impetus to become involved in the cold fusion field, should it ultimately prove successful, is obvious.

3. The Important Questions

As mentioned previously, the important question is not, "Does cold fusion occur?" Instead, for a company interested in becoming profitably involved in the cold fusion field, the important questions which require answers are:

- Can cold fusion be used as the basis for useful, practical energy producing machinery?
- Will that machinery achieve widespread use?
- Can the machinery be made available in the foreseeable future?
- If the first three questions can be answered in the affirmative, how can and should the company become involved?

To answer these questions, a phased approach to investigation and development is recommended. The phases, their purpose, and the methods used to accomplish them are described in the following.

4. Phase 1 — Survey the Field

This purpose of this phase of the investigation is to develop a solid corporate understanding of the state of the cold fusion field. This phase of the plan is intended to generate the following information:

a. A detailed understanding of the different techniques known to produce the cold fusion effect.

b. The state of development of each of the cold fusion techniques, including:

- Method and apparatus
- Level of excess heat or energy production
- Known parameters and unknown factors requiring additional investigation
- Materials involved

c. An understanding of the theoretical explanations for the effect, along with supporting evidence for each theory.

d. An acquaintance with the researchers in the field; an understanding of their capabilities, funding, and plans; and an understanding of their willingness to participate with a large corporation.

To the maximum extent possible, this phase of the investigation will be performed on a first-hand basis. Researchers will be visited at their laboratories, and their experimental apparatus will be observed. Theoreticians will be contacted, and their theories will be discussed in depth. A corporate cold fusion library will be established, and a systematic review of key publications will be performed.

5. Phase 2 — Establish the Broad Parameters of Practical Machinery, Economic Attractiveness, and Timetable

The purpose of this phase of the investigation is to make educated guesses concerning the form commercial cold fusion devices may take. The cost of commercial devices will be estimated based on these guesses. Approximate timetables for the development of each technique will be generated, based upon the state of development the technique. This will involve performing the following steps for each of the techniques known to produce the cold fusion effect:

a. Select a device configuration. A reasonable approach would seem to be to choose an existing experimental cold fusion device which has demonstrated high levels of excess heat in a repeatable manner.

b. Estimate the size of the device needed to produce power at usable levels. A prudent approach would be to examine three sizes which will cover the range of possible devices: Electric power plant size (hundreds of megawatts), home heater/generator size (tens of kilowatts), and an intermediate size.

c. Estimate the cost of the devices if they were to be commercially produced. There is the possibility of large errors in this step, but one approach would be to identify existing industrial machinery for which a production cost is known and which is similar in form to the cold fusion device under study. The production cost could then be adjusted to account for differences in the materials of construction, difficulty of manufacture, and expectations of production volume.

d. Estimate the life-cycle cost of the device. This would include replacement of materials, operating costs, fuel costs, etc. Again, the most promising approach would be to make comparisons with similar machinery in use today.

e. Perform economic sensitivity analyses. These would examine the impact on device costs of changes in the parameters which are presently uncertain. This would include:

- Performance of the device: For example, how would the cost of the machine vary if a higher level of excess power were achievable? Is there a minimum level of excess power which makes the machine economically viable?
- Cost of materials: For example, if increased demand for palladium were to substantially increase its cost, what impact would this have on the cost of the total machine?
- Size of the Device: The machine may be most economical in a particular size range. This will impact the way the device is ultimately implemented in the marketplace.

f. Based on the above estimates, compare the cold fusion device with energy sources available today. Determine the implications for the ultimate economic attractiveness of the device.

New Energy Times Archive

g. Make a realistic estimate of the size of the market.
h. Establish an approximate timetable for development of the device. This timetable would be based upon the current state of development and the amount of additional work and research required to bring the device to a state of commercial viability.

6. Phase 3 — Examine the Legal Implications

The purpose of this phase of the plan is to attempt to define the legal arena in which the company will be operating.

The sorry state of the cold fusion patent situation is well known. Almost no patents have been granted, and most researchers are operating without patent protection. This has probably had the effect of limiting communication among researchers to some extent. But this is not likely to be a corporation's major concern.

To a corporation interested in becoming involved in this field, securing patent rights will be an important aspect of that involvement. Several hundred patent applications have been prepared for cold fusion devices, and they undoubtedly have many overlapping claims. Detailed legal research will be necessary to attempt to understand the legal necessities of operating in this field.

7. Phase 4 — Identify the Work Remaining

There are many issues which must be addressed before practical cold fusion devices are developed. The purpose of this phase of the plan is to identify the issues, determine what work remains to be accomplished to address them, and determine what talents must be assembled to perform that work. Some of the more critical issues are discussed below.

a. Theoretical Basis

A sound theoretical basis for the cold fusion effect will ultimately be required. Without it, improving the performance of devices will be a trial-and- error affair. A theory with predictive capabilities would be extremely helpful. A series of experiments is required to test the more promising theories.

b. Configuration

Configurations that produce higher rates of excess heat generation need to be examined. Examples include electrode surface area and volume, and the role of grain boundaries. A systematic examination of configuration effects will need to be devised.

c. Temperature

Most experimentation to date has been at low temperatures. Producing practical devices at these temperatures will most likely be difficult. The extent to which more thermodynamically useful temperatures can be achieved requires investigation.

d. Repeatability

In terms of much cold fusion research to date, repeatability means the ability to reliably produce the cold fusion effect. This in itself will not ultimately be sufficient. A practical device will need to reliably produce the cold fusion effect at a power level which is known and repeatable.

e. Throttling

To be truly useful as a practical machine, it will be necessary to have a mechanism to throttle a cold fusion device. This means the ability to turn it on and off at will, and to vary its output. Mechanisms to accomplish this will need to be explored.

f. Radiation

The general attitude in the cold fusion community is that radiation generated during experiments is good, because it demonstrates that a nuclear process is at work. The business perspective is exactly the opposite. Concerns about radiation (whether those concerns are rational or not) have severely affected the development of fission power in the United States and other parts of the world. Even if the radiation emitted from cold fusion devices is very low, irrational fears could be very damaging. The levels of radiation that can be expected from practical devices needs to be well examined.

g. Long-term Performance

Many cold fusion experiments have been short-term. Longer term testing is required to determine what periodic maintenance and replacement will be necessary with a commercial device. In other words, will the electrodes or some other parts of the devices "wear out" with time? How often will these parts need replacement or replenishment? How will this be done and how much will it cost?

A series of long-term experiments will be necessary to examine this issue.

h. Power Conversion

Methods must be developed for converting the excess heat generated by cold fusion devices into electricity. Reasonably high conversion efficiencies are likely to be required. It is not sufficient to say that the source of energy is cheap and plentiful and therefore conversion efficiency is not an issue. Solar energy is cheap and plentiful, yet low conversion efficiencies have so far made widespread implementation of solar power uneconomical.

So, potential power conversion technologies will have to be identified. Modifications required to match them to the output characteristics of cold fusion devices will have to be explored.

8. Phase 5 — Establish Working Relationships

Phase 4 described above will identify the areas requiring work. Based on this, the talents and resources required to perform the work will be established. The purpose of Phase 5 will be to establish relationships with other organizations. In its traditional role as systems integrator for large, complex projects involving many different organizations, the A/E may be particularly suited to establishing consortium and joint venture arrangements.

Participants would include researchers in the field, companies and laboratories with the necessary expertise to perform the work, and companies with an interest in sharing costs and risks.

9. Phase 6 — Perform Directed Experimentation

The purpose of this phase is to perform experimentation and research in a logical manner to address the issues raised in Phase 4. The work would be performed by the organizations assembled in Phase 5.

10. Phase 7 — Develop Prototypes

Once a sufficient number of the outstanding technical and economic questions have been addressed, it will be possible to build and test prototype devices. By this time in the process, the information which has been generated will probably have narrowed the candidate configurations to a small number. The most promising will be constructed.

11. Phase 8 — Initiate Commercial Implementation

If all the earlier phases of this plan achieve success, and the economic outlook is positive, the ultimate goal of all the cold fusion efforts will be possible: commercial implementation. It is not possible at this time to describe the form this implementation will take; generating that information is the goal of the first seven phases of the plan.

12. Summary

The potential impact of cold fusion on a company currently involved in the energy industry is too great to ignore. If a phased approach is used, in which

New Energy Times Archive

each phase represents an increment of financial and technical involvement, the company can minimize its financial exposure while still establishing a favorable competitive position. The benefits of such a plan are further enhanced if the company pursues this work in cooperation with others already involved in the field.

Electric Spacecraft Journal Network

Keeping you informed about independent research.....

The ESJ Network assists individual research efforts, facilitates cooperation among experimenters and provides an open forum for the exchange of information an ideas. The Network provides a medium for direct interaction among associates. We urge individuals doing independent research to network.

The Network welcomes those engaged in experiments, analysis, conceptual thinking, and investigative research, who are willing to interact with others. Inquiries to: 704-683-0313 or 704-683-1280, Fax: 704-683-3511

Subscriptions to the quarterly *Electric Spacecraft Journal*, 73 Sunlight Drive, Leicester, NC 28748 USA.
Annual Subscription rates: U.S.A. $24; Canada and Mexico $29; Overseas $39.

Alchemy Nightmare: *Skeptic Finds Heavy Element Transmutation in Cold Fusion Experiment! Hidden 3-years...*

At ICCF5 in April, EPRI (Electric Power Research Institute) cold fusion program director Dr. Tom Passell gave an overview of the cold fusion field. The biggest news from his talk, however, was the first *public* revelation of the results of the EPRI-funded work of physicist Dr. Kevin Wolf at Texas A&M University. This research occurred back in 1992, but others—including Dr. Wolf—have since tried to keep these results from surfacing. Why?

Because the work shows unambiguous evidence of the transmutation of heavy elements by some heretofore unknow nuclear process in a Pons-Fleischmann-type cold fusion experiment. Why would Wolf want to sit on a possible major insight into the working of "cold fusion"?

You see, Dr. Wolf was initially an extraordinary pioneer in the cold fusion field. He made early announcements in the spring of 1989 that he had detected neutrons and tritium in cold fusion experiments at Texas A&M. It seems that Wolf later lost his nerve during the spate of scurrilous attacks by journalist Gary Taubes in 1990, who alleged that tritium could be explained by fraudulent spiking of cold fusion cells in the laboratory of Professor John O'M. Bockris, also at Texas A&M. (These charges were immediately shown to be false and without any scientific merit, but they have been repeated by Taubes and others, who continued to pollute scientific discussions of the field.)

Dr. Wolf concluded in 1990 that his tritium results were flawed and were most likely the result of pre-existing contamination of his palladium. He "withdrew" these results in the general press, but did not issue a formal retraction to any journal, as far as is known. Thereafter, he became a quiet skeptic of the cold fusion field, even though he continued to be funded by one of Dr. Passell's colleagues at EPRI, a skeptic who was bent on tearing down cold fusion. Wolf continued his electrochemical cold fusion experiments, reportedly continuing to find low-level neutrons, but nothing else of interest.

In 1992, Dr. Wolf made an amazing serendipitous discovery while chasing down low-level neutrons. Three of his palladium cathodes that had undergone Pons-Fleischmann electrolysis in heavy water were found by Geiger counter examination to be palpably radioactive! Subsequently, the cathodes were exmined in sophisticated gamma-ray spectrometers at various laboratories, which could observe the intensity and precise frequencies of the gamma ray lines. Those experts, including Wolf, who saw the multiple spectral lines of gamma emission had no doubt that these were the signatures of radioactive isotopes with masses near that of palladium.

Unfortunately, Dr. Wolf could not imagine that these astonishing results—*in which he believed fully*, but could not thereafter reproduce— had anything to do with "cold fusion"! That's right, he is said to believe to this day that these radioactive isotopes were *not* due to anything fundamentally connected with "cold fusion." He thinks the results may me due to the effects of cosmic ray impacts in the earth's atmosphere—*which just happend to be detected in his "cold fusion" experiment*. He is said to believe that hypothetical Weakly Interacting Massive Particles (WIMPS) may have caused these transmutations. Pun intended: we respectfully suggest that Dr. Wolf has wimped out on his own, solid data.

The world was prevented from hearing about this work last year. Dr. Wolf had been scheduled to talk at ICCF4 on Maui, Hawaii in December 1994 on a "To Be Announced" topic. He was "encouraged not to attend," by his cold fusion skeptic funding agent.

New Energy Times Archive

The Passell Presentation

Just what did Tom Passell's ICCF5 presentation show? It indicated that in 1992, about six weeks after a Pons-Fleischmann-type cold fusion experiment was completed in Dr. Wolf's lab, at least one cathode was found to be inexplicably radioactive.

Gamma rays from at least seven radionuclides were unmistakably observed. The number of counts observed per peak is on the order of 10^4-10^6 counts, with a signal-to-noise ratio of ten. Under these conditions, the statistical significance of the data is extremely high. Since there is no known explanation for how palladium can be made radioactive, it is can be assumed that the "cold fusion" reaction, whatever that is, was involved in some way.

Table I shows the radionuclides which were detected, and their original concentration is back-calculated to the time when they were assumed to have been created (since radioactive nuclei are transmuted into some other nucleus when they decay, the inventory of radioactive material is constantly changing).

Figure 1 shows graphically where these radionuclides appear in relation to the stable nuclei. In this chart, different numbers of protons are laid out vertically (protons determining the identity of each element) and the number of neutrons are laid out horizontally. Isotopes of the same element may have different numbers of neutrons. Stable nuclei are shaded; the specific radionuclides reported by Passell are outlined in bold. Note that there are six stable isotopes of palladium. These are Pd-102, Pd-104, Pd-105, Pd106, Pd-108 and Pd-110. All of these nuclei are stable and occur in natural palladium.

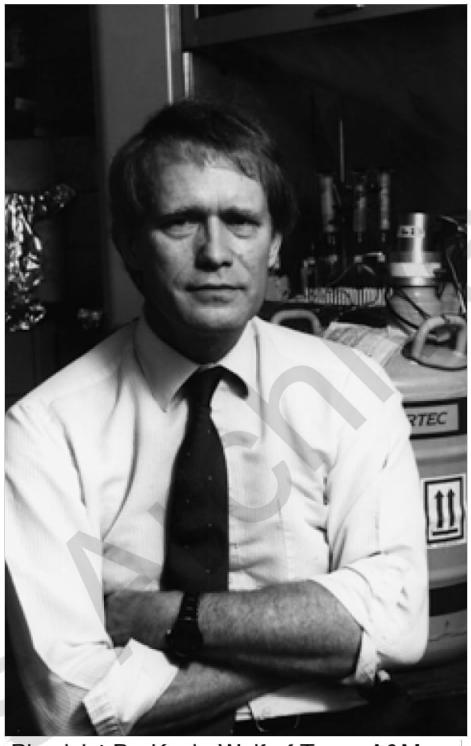
MIT's Peter Hagelstein has argued that the atomic lattice may couple with individual atoms, producing metastable (highly excited) states in individual nuclei. Under some conditions neutrons can even "hop" from one atom to another.

This could possibly yield some clues for some of the radionuclides. For example, it would not be too far-fetched to imagine that some excited state Pd-110 might emit a beta particle (changing a neutron to a proton) resulting in Ag-110. One might imagine that Ag-106 might be created via a similar mechanism. To produce Ru-103, Pd-108 might lose a neutron via a neutron hop and then alpha decay. These reactions are, hypothetically at least, worth considering.

But how would rhodium-99 be obtained? One way, as Passell pointed out, would be to assume that a proton is absorbed by Pd-102, quickly followed by alpha emission. This would temporarily create Ag-103, and then Rh-99 upon ejection of the alpha particle, since an alpha particle consists of two neutrons and two protons. Still, many scientists find it difficult to accept that a proton could get close enough to interact with a larger nucleus, since both are positively charged and thus strongly repel each other via Coulomb repulsion.

Other possibilities are that the Rh-99 resulted from Ru-99 (present as a minute impurity in palladium—approximately 5 ppm in Johnson-Matthey's highest grade of palladium, for example). Obviously, in this case it must be asked why only impurities with atomic numbers close to palladium participated in the transmutation event. Specifically, why would Ru-99, in particular, participate so strongly in the transmutation reactions, given its small abundance.

Another possibility is that *three* neutrons might leave from Pd 102, forming Pd-99, which could then positron decay (that is, emitting an antimatter electron) to Rh-99. Low neutron isotopes such as Pd-99 tend to be positronic emitters, incidentally. If indeed many neutrons are able to somehow downshift from neutron rich isotopes to neutron-poor isotopes, then it might be suspected that other



Physicist Dr. Kevin Wolf of Texas A&M University. *Photo: Courtesy Texas A&M Information Service*

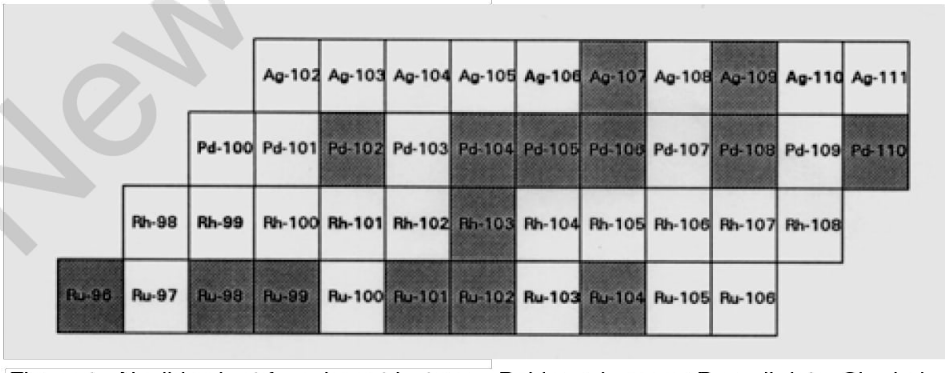


Figure 1. Nuclide chart for relevant isotopes. Bold numbers are Passell data. Shaded boxes are stable isotopes.

Table 1.
Elements Found in Wolf/Passell Data

Isotope	Abundance
Silver 110M	0.8B
Rhodium 99	2.7B
Ruthenium-103	3.7B
Silver 106m	4.5B
Rhodium 102m	6.3B
Palladium 100	7.7B
Rhodium 102	12B
Rhodium 101	12B
Rhodium 101m	22B
Silver 106	26B

New Energy Times Archive

stable nuclei are being produced. If that is so, perhaps a mass spectroscopic study would reveal abnormal isotope ratios within the palladium series. However, this has not been attempted.

The bottom line is that no one knows what could possibly result in the bizzarre data presented by Passell. Additional experiments could perhaps clear the picture, but in the present environment of minimal funding for cold fusion nuclear effects work in the U.S., that seems unlikely.

In any case, the tendency to zero in on fusion reactions as the probable source of the cold fission effect must be revisited. Certainly the fusion of light isotopes such as deuterium and hydrogen does nothing to explain the transmutation of heavy metal isotopes

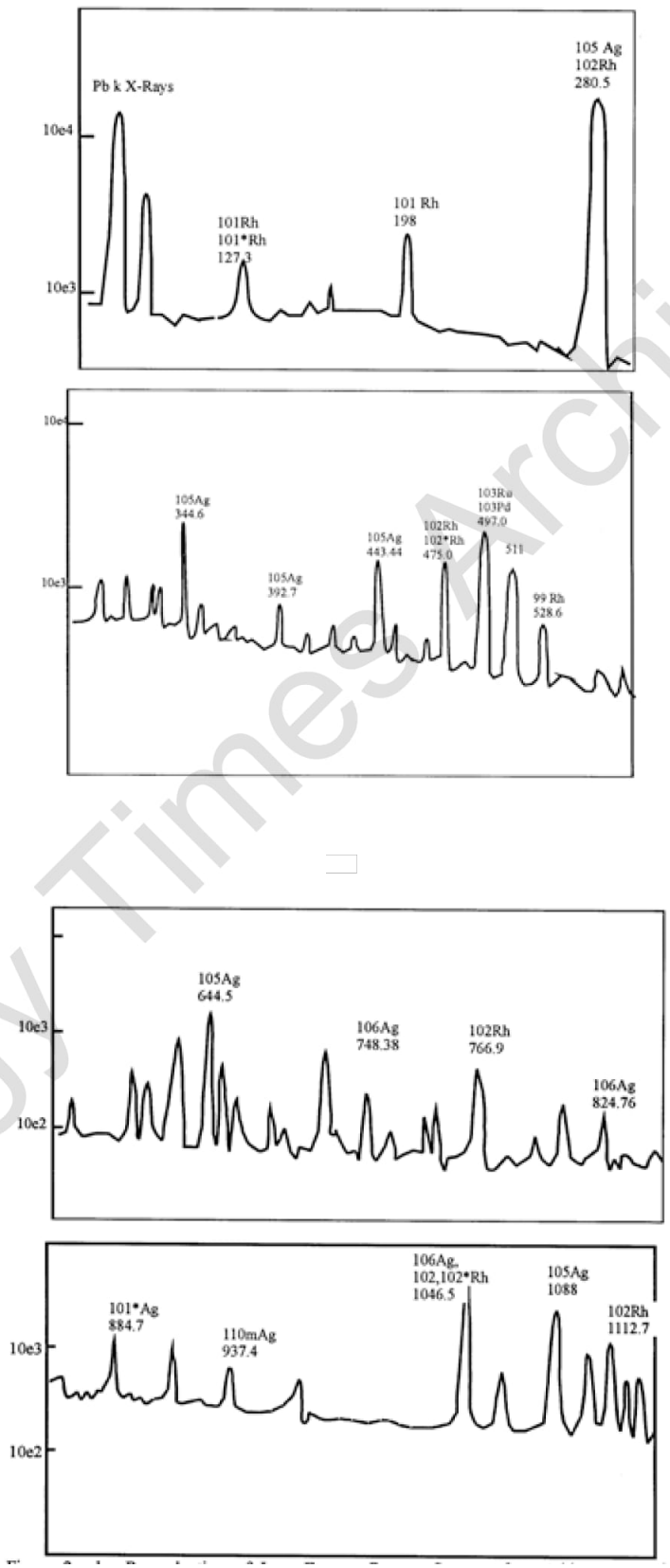
On the other hand, it may well be asked what evidence there is that light element fusion contributes at all to the observed cold fusion data set. Helium production may result from D-D fission, as has been pointed out countless times. However, helium is also created from alpha decay of heavy elements. We might ask ourselves, therefore, whether there exists any evidence in favor of unexpected fission versus unexpected alpha decay.

Tritium, also claimed by many experimenters, is also a possible fusion product from D-D fusion. However, if neutron transport occurs in other ways (such as Hagelstein's proposed neutron "hopping" mechanism), we might wonder if it is possible to create tritium by neutron hopping from a heavy atom such as palladium to deuterium. Thw, the nuclear reactions observed by cold filsion experimenters may not be fusion at all. Maybe it is something even more profound that is raising havoc with nuclear stability—such as, perhaps, the tapping of the vacuum energies of space itself, ZPE?

Science is magic that works.

—Kurt Vonnegut

Quoted in *Fire from Ice*



Reproduction of gamma spectra from the video tape of Dr. Passell's presentation at ICCF5. *(Permission to tape and distribute information, granted by Dr. Passell)*

New Energy Times Archive

Energy Bombshell from Moldova...

Water Fuel Device Conquers the Marketplace!

by Christopher P. Tinsley, Nottingham, UK

Perhaps the oldest of military regulations is "Never Volunteer." It was my disregard for this wise and ancient rule which led to my arrival in late May (without a visa) at Kishinev, the fair capital of the former Soviet Republic of Moldova.

Fortunately, I was in the company of that gentleman, scholar, linguist and distinguished scientist, Dr. Peter Glück of Cluj in Romania. It was he (clearly believing – maybe rightly – that I was some naïve and innocent Westerner) who had met me at Bucharest's Otapeni Airport, and accompanied me on what might best be described as an 'interesting' journey by train.

One of the interesting things about the journey from Bucharest to Kishinev is the length of time it takes. Another is the removal of each carriage in turn from its bogies, and its placement on a different set of bogies – ones designed to fit the different separation of Russian rails. Fortunately, this naive Westerner had taken the precaution of providing himself with a large bag of peanuts and raisins, so we did at least have something to eat while being harangued by officials who did not seem to care that Intourist in London had told me that visas were obtainable at the border. The letter of introduction which I had asked Dr. Arthur C. Clarke to write also proved its value at this point.

But what, you might ask, was your humble scribe doing in Moldova with a distinguished Romanian scientist, no visa, a bag of peanuts, and a letter of introduction from Arthur Clarke?

Preceded by many rumors, reports at ICCF5 had formally confirmed the existence of a micro-cavitation water heater being sold commercially in the CIS. Independent reports from Moscow stated quite clearly that the machines were over-unity – they produced far more heat energy than they consumed in electricity. Peter Gluck had visited the offices and factories of the VIZOR company in Kishinev, had reported back that there was indeed a thriving company manufacturing these devices; and had himself conducted preliminary tests which showed the over-unity effect. The purpose of our journey was, therefore, to purchase some of the machines, and obtain documentary evidence of their commercial success and over-unity performance. Somebody had to do it, and I volunteered. For all its minor discomforts and difficulties, this became the most extraordinary trip that this "Wandering Goy" has ever made – so far.

(L-R) Dr. Peter Glück of Romania, Prof. Lev G. Sapogin of Russia, and Dr. Yuri S. Potapov of Moldova, inventor of the Yusmar thermogenerator, examine a demonstration heating unit at VIZOR in Kishinev.

For, make no mistake about it, the machines are real. The commercial success is real too. Without the generosity of Dr Clarke, the journey would have been at the very least delayed. Arthur Clarke has frequently made the future by defining it in advance, but on this occasion he may well also have speeded into reality – in his own lifetime – something which he had suggested in a novel as a possible energy source of the far future. This is not at all certain but, for reasons I'll explain, I lean strongly towards that idea.

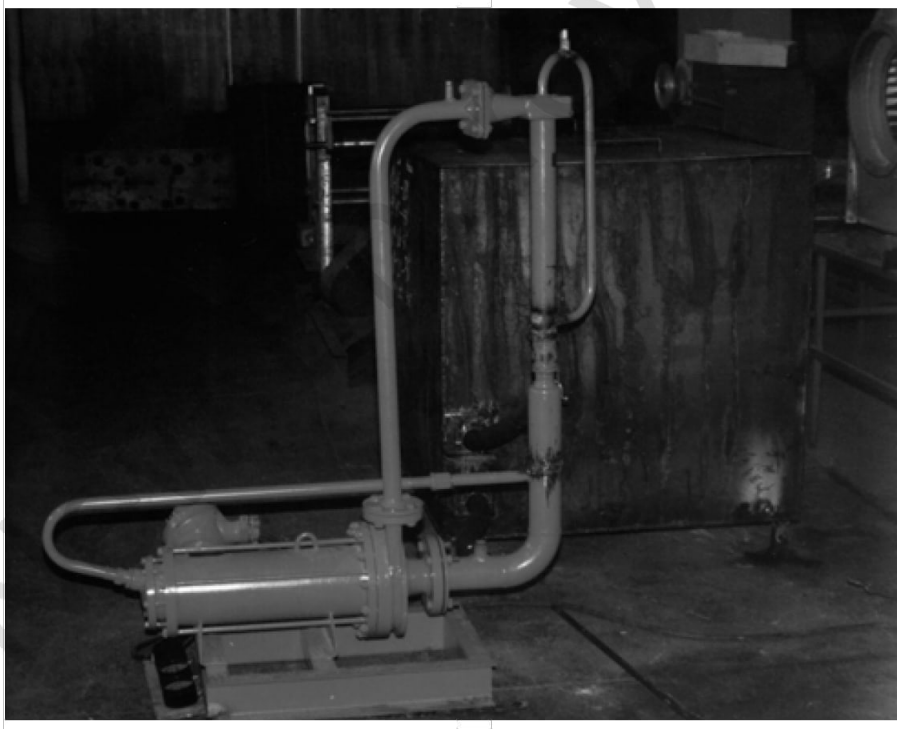
Despite Peter's report, I didn't know what to expect to see at VIZOR. I certainly didn't know what to expect of Kishinev either. Bucharest hadn't been much of a surprise, because it has featured so much on television in recent years. But, irritating as it probably is to the Moldovans, few Westerners are even quite sure where it is. It is a small country lying to the northwest of Romania, and Kishinev is a pleasant and obviously thriving city. It may be that – as it seems – the old Soviet bureaucracy still exists there, but there is an air of energy and purpose to the place.

The head of VIZOR and the scientist who is the inventor of the machines we had come to see, Dr. Yuri Semionovitch Potapov, gave Peter and I a full day of his time. Or as much of it as he could, he spent quite a lot of it trying to fend off customers who wanted more and more of his units. Fans of the series *Monty Python's Flying Circus* will recall the regular appearance on the show of the Spanish Inquisition in their robes. By contrast, we had a group of Orthodox clergy, who told us at length of the great savings they had found with the Potapov heating machines. One of these, a local parish priest, had tried to

New Energy Archive

Close-up view of a small heating unit showing its small vortex chamber (to the right of the motor and centrifugal pump), two radiator panels, and temperature control box.
Photo: C. Tinsley

do a calorimetric study to find out just what was happening. The vagaries of the Moldovan electricity supply had defeated his efforts, but hadn't dampened his enthusiasm for the cost savings he'd had over the winter. Dr. Potapov agreed to install a larger machine in a nearby monastery, so that not only the water but the monks' cells could be heated. Further, he decided that he would install it at no cost to the monks. In fact we found out during the day – mostly from Dr. Potapov's enthusiastic staff – that he provides significant sponsorship to many Moldovan cultural and artistic people. He was also completely happy that all our discussions were made under the watchful eyes of the 8mm video and 35mm SLR camera I had brought with me. I had complete freedom to film and photograph anything whatsoever. So I did, and the resulting record has been seen with astonishment and enthusiasm by quite a number of people.



Small Yusmar thermogenerator at one of VIZOR's factories. The cubic-meter-size steel water chamber behind unit is used for testing; it replaces the radiators. Curved pipe from the top of the vortex chamber to the mid-section of vertical pipe is apparently necessary for the high pressure, high flow rate vortex hydrodynamics. *Photo: C. Tinsley*

I declined to perform the calorimetric tests which were offered. The only installation which was available at the time was the heating system for an experimental workshop in the Institute for Applied Physics, and it just wasn't practical to make satisfactory measurements. I could have done so, if I had been prepared to accept the figures for water volume and power consumption; and perhaps in a full day it would have been possible to get some kind of crude figures for static calorimetry. This failure should have dampened my enthusiasm, but it didn't.

The real reasons for my enthusiasm are – apart from the personality of Dr. Potapov – the obvious commercial success of the company, and the unarguable volume of production of the heating machines. At one point I filmed two hundred of the middle-sized Yusmar units awaiting shipment awaiting shipment, and large numbers of the very large Yusmar 3-M and 4-M machines, which are suitable for heating hotels or factories. (The name "Yusmar" comes from Yu S [Potapov] with the 'mar' coming from the name of the Moldovan opera singer Maria Biesu). I understand that some customers buy only the basic unit, which is quite small; but most seemed to be sold complete with the pump and electric motor which drive the fluid through the unit itself. The motor is the sole source of power to the Yusmar device.

It might be pointed out that none of these things suggest an over-unity machine. That is quite funny to anybody who has spent much time in manufacturing industry. If anybody is having trouble with this piece of elementary logic, the answer to the riddle is at the end of this article. Heretical as it may be to suggest this, there *are* other means than the purely scientific for the assessment of reality.

But what is happening inside a Yusmar? The way Dr. Potapov tells it, it's quite simple. A vortex is established in the liquid in the tube. The velocity gradient within the liquid is so great that cavitation occurs – not between the liquid and the tube walls, but between adjacent layers of liquid.

Top Left: Four sizes of Yusmar thermogenerator vortex chamber cores displayed on the floor at VIZOR headquarters, Kishinev.

Middle Left: Dr. Peter Glück, Dr. Yuri Potapov, and Prof. Lev Sapogin in Dr. Potapov's office.

Lower left: Yusmar vortex chamber units at factory in Kishinev await inlet-cone attachment and painting. Factories in Moldova are already in high-volume production of these units. Demand is high.

Photos: C. Tinsley

This is of course reminiscent of the Griggs Hydrosonic machine, but in that device the cavitation is induced by shear between metal and liquid, not between layers of liquid.

Both the Yusmar and the Hydrosonic device produce excess energy. The Yusmar seems to be the more effective and simpler of the two, with tests being done in Belarus which suggest Coefficients of Performance (COP) of as high as 10. That is, ten times as much heat being produced as energy taken by the motor.

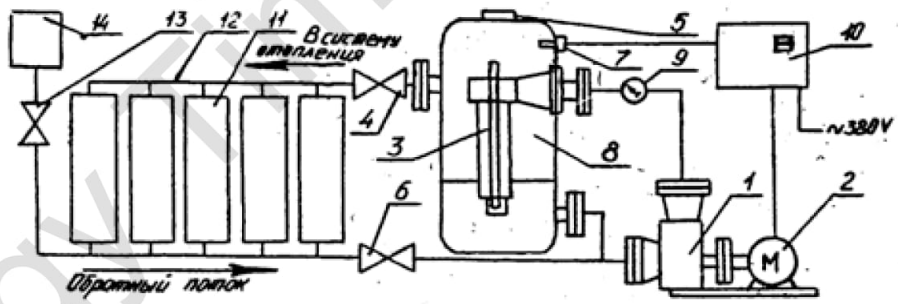
The various independent test results do show a rather alarming variation in COP. A closer look shows that this appears to result largely from different parameters of use. The performance of the machine depends critically on a number of variable factors – liquid viscosity, flow rate, and the like. It is hoped that the tests due to start shortly in the USA will provide a proper set of performance curves to show how these parameters change the COP.

It is well-known that "no experimental results can be accepted without theoretical confirmation." That is true within science, but – happily – not within the world of commerce. Even so, we must ask what is the source of the energy. No energy source other than chemical or nuclear energy is accepted by conventional science as being applicable to a machine of this kind. Chemical energy could not supply such power for any length of time, which leaves nuclear power – mass-energy conversion. Prof Lev Sapogin of Moscow has proposed a most interesting theory to explain the Yusmar machine, but his idea is for mass-energy conversion which is unrelated to conventional nuclear energy. What is certainly true is that unless there is a transformation of a stable nuclear species to another stable one, with no nuclear radiation emitted, then the energy does not have a nuclear source as we understand it. Thorough

searches have been done for X-rays, gammas and neutrons, with nothing found. Admittedly, some lower energy particles might fail to penetrate the thin wall of the Yusmar machine. But it is difficult to see how they could even be occurring with no effect on the machine or the water which flows through it. Raising of the natural level of deuterium in the water by a factor of ten appears to have no effect. The machines work just as well with the addition of ethylene glycol, they work with oil - they can even be made from food-grade stainless steel and used for pasteurising milk.

What, then, is the source of the energy? Professor Sapogin's theory - that matter is being converted into energy by other than conventional nuclear means requires more understanding than I am able to bring to it. For nuclear energy to be released under these sorts of conditions - even without any high energy effects - seems wildly improbable. The remaining notion is that the energy of the 'quantum vacuum' or Zero Point Energy is being tapped in some way. The appeal of the last idea is that there is at least a pre-existing theory for such a mechanism; even if its application in this case seems more than a little obscure.

A city square within Kishinev, Moldova as viewed from the hotel of the visiting scientists.
Photo: C. Tinsley



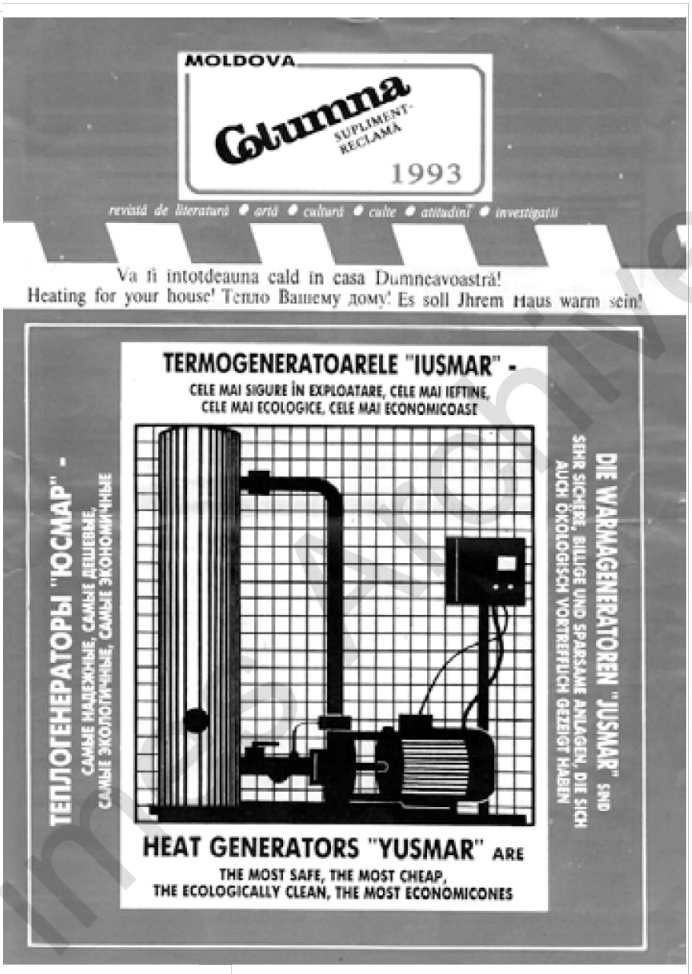
System diagram for thermogenerator installation and testing. Central tank holds vortex chamber unit. Radiator panels are to the left. Centrifugal pump and motor at lower right.

Dr. Yuri S. Potapov

One thing is worth considering, even if only as a synthesis. The 'microfusion' machine of E-Quest operates by ultrasound-induced micro-cavitation. The Griggs machine and its predecessor use it too. The phenomenon of sonoluminescence occurs in micro-cavitation and, to judge by the article "Bubbles Hotter Than The Sun" [*New Scientist*, April 29 1995], not a very great deal is understood about the physics of these tiny bubbles. Another thought is that the destructive effects of cavitation have presented engineers with difficulties for decades, but perhaps there has been a opportunity hidden in the problem - and the attempts to suppress the problem have caused the opportunity to be missed.

And the answer to the little riddle? How do we know a machine is over-unity without testing it? The answer is simple enough. If a machine sells widely as an electrically-driven water heater, in countries which are struggling to recover from a massive economic collapse, and satisfied customers keep coming back for more - then you have a mystery to solve. If the machines cost many, many times more than an immersion heater (which is by its nature virtually 100% efficient, and is presumably more reliable than the Yusmar pump-and-motor-and-vortex-tube) - then you have a mystery which is soluble only by accepting that market forces operate just as well in the Commonwealth of Independent States as they do everywhere else. Doubtless our Gentle Editor will be fascinated to hear any alternative suggestions.

Photo from the October, 1994 English language *Business Match* Magazine, published in Russia. (L-R) Prof. Lev Sapogin of MADI Technical University, Moscow; Oleg Finodeev, an engineer with a U.S. corporation; Vladimir Nikitsky, deputy designer general, *Energiya* Concern, Russia; and cosmonaut Vladimir Djanibekov. Courtesy: *Business Match* Magazine:
(095) 916-9444, or (095) 923-6244



Colorful advertising brochure for Yusmar heat generators, in multiple languages, which indicates the widespread use of these devices in Europe and Asia. It is difficult to understand the market penetration of these thermogenerators if they were not effective in reducing heating costs below those of standard electrical immersion heaters. Since the Yusmar's are driven by electrical pumps of less than 100% efifciency (60% or less, typically), this strongly suggests that an "over-unity," excess power effect is present.

Infinite Energy will keep you informed on the status of calorimetric testing of the "Yusmar" devices of Dr. Yuri Potapov. These tests will be occurring this summer in both the U.S. and in the U.K. Don't miss our continuing coverage of this apparently remarkable turning point in the "cold fusion" and new energy saga.

—The Editors

New Energy Times Archive

On One of the Energy Generation Mechanisms in Unitary Quantum Theory

by Lev S. Sapogin
Department of Physics, Techrical University (MADI),
Leningradsky prospect 64, A-319, 12582,, Moscow, Russia

It is now a well established fact that in Cold Nuclear Fusion (CNF) only a small portion of heat results from nuclear reactions, the rest being of a mysterious origin. In this connection Prof. Peter Hagelstein writes in [1]: "Some say that this heat can be explained easily by elementary chemical reactions, phase changes, or battery-like storage effects. I have trouble with these explanations." For instance, nickel electrolysis in light water produces the same amount of energy as that of palladium in heavy water. Besides, we have to consider a no less mysterious phenomenon of sonoluminescence, that was discovered in Russia in 1933 by S.N.Rzhevkin. At first sight these phenomena seem to bear no correlation. But Julian Schwinger, the Nobel Laureate and profound research worker, has drawn parallels between cold fusion and sonoluminescence in his continuous technical publication on both topics. He notes in [2]: "Like Cold Fusion, sonoluminescence 'should not exist,' but it does. This now well established phenomenon occurs when ultrasonic sound, beamed into liquids, causes bubbles to oscillate stably—to expand and contract regularly—and also to emit regular pulses of light."

But one is positively struck by the heat generator built by Dr.Yu.S.Potapov (Kishinev, Moldavia), which produces in water cavitation bubbles, generating 12 kW of heat on 4 kW of electric energy input.

This is achieved by the aid of a centrifugal pump that runs light water through a tube with a number of special attachments. Similar, though less effective results, have been obtained in the USA by James Griggs [3]. The reactions taking place in the above-mentioned cases can be explained neither in chemical nor in nuclear terms. Moreover, Potapov's system is now in production and used for heating homes. There is no doubt that the described phenomena can be viewed as "new physics" and it is impossible to describe them within the laws of conventional science.

Below it will be shown that Unitary Quantum Theory (UQT) allows one to explain all these seemingly unrelated effects. UQT was developed in l970-1988 and its validity is proved by the fact that at a limited number of cases the theory results in both the Dirac's equations and the relativistic equation of Hamilton-Jacobi. Moreover, the solution of the approximate UQT equation has yielded the electric charge value and that of the fine structure constant with reasonable exactness, the result being achieved for the first time in theoretical physics [6-14]. The solution allowed the formulation of one more approximate equation for the oscillating charged particles model which gives promising results in dealing with the deuterons interaction problem (the basic CNF problem) [4, 5].

Let us consider more closely, as it was done in [4, 5], the particles' behavior in a potential well. The equation describing this process can be expressed in the following way:

(1) $x = \mathrm{GRAD}\ U(x)\ \cos(\ t\ x^2\ /\ 2\ x + x\ x + f0)^2$

where U(x) is a potential and x, x, t, f0 — a coordinate, velocity, time, and initial phase correspondingly. This equation manifests a number of peculiarities. Having integrated it once, we arrive at

(2) $x^2 = 2\ W\ (x,t)$

where W(x,t) is some time-dependent complex potential not amenable to analytical expression even for the simplest U(x). Therefore, nothing can be said about the integrals of motion. Equation (1) behaves very peculiarly in translation-invariance conditions. It doesn't exist in the common case but manifests itself at translations divisible by p . That means that two classes of solutions are available: for the first class the laws of energy and momentum conservation are valid, while for the second class they are not.

Numerical computation for the parabolic well yields solutions of four types that result from different initial conditions. Similar results can also be obtained for other potentials [4].

l. The stable standard periodic solutions are obtained only for definite discrete energy E values equal to (n+1/2)hw at n=0,1,2... and at definite values of x, x, f0. Trite solutions of the same kind are available in conventional quantum mechanics and will not be analyzed in this paper.

At other initial conditions three more types of solutions arise:2. The particle performs complex oscillations of a diminishing amplitude. Sometimes at certain x, x, f0 values the process starts at an increasing amplitude with its consequent decrease. At this point the particle charge and mass approach zero and after some rather long period of time the former ceases to exist altogether. This is not surprising because in UQT the particle is defined as a periodically emerging and disappearing wave packet. Its complete disappearance means that the packet's harmonic constituents have scattered so far from each other that the packet itself ceased to exist, its energy given away to the vacuum, smeared out throughout the entire space, manifesting itself only in the form of vacuum fluctuations. Let us call this solution "a crematorium."3.The particle performs complex oscillation with an increasing amplitude, yet sometimes the process can develop with an initial short-time decrease in the amplitude. In doing so the particle's energy can increase indefinitely, if the potential well's parameters do not change. Physically this means that the particle takes energy from vacuum fluctuations but the mechanism of this process, of how it does so can be deduced only from equation (1). Let us call this solution "a maternity home."

4.There is also a diffusion solution, in which the particles tunnel into the potential gap wall. This solution is similar to that of the particle's behavior at the potential step, whence the particle in the course of considerable period of time can penetrate deep into the step. Periodic and irregular oscillations determine the energy discrete and continuous regions, respec-

New Energy Times Archive

tively.

From a purely aesthetic point of view, it is desirable that the quantity of energy (matter) disappearing in the "crematoria" should be equal to that emerging from the "maternity homes." But I am not yet in a position either to prove or disprove it.

Solutions 2 and 3 are incompatible with conventional quantum mechanics, whence solution 4 corresponds to exponentially decaying (damping out) wave function tail at large x values.

If the system contains a number of identical wells, all the decisions of type one will be identical for them and that is the reason why the discrete energy levels are easily traced out in the experiment. But there will be no discrete levels L or solutions of type 2 and 3 because each individual decision will possess its own peculiarities. The availability of these solutions can be perceived only through integral effect— either the energy release or drastic charge, or mass variation in the system, being in itself a very specific phenomenon.

Let's take a more close look at intriguing solutions 2 and 3. I was aware of them as far back as two years ago, which can be seen in [5, p.98]. But I was afraid to discuss the matter in my publications in the absence of reliable experimental data. Even now I am in mortal fear lest my reasoning turns out to be erroneous. But the situation has since changed and one can say now with certainty, that within UQT in quantum processes the energy and momentum conservation laws have grown from local to a global one, i.e. in individual processes the energy and momentum are not conserved, but may be taken from or given away to the vacuum. Nevertheless there exist some range of phases when the energy and momentum are preserved locally. Being summed up throughout all phases for a large number of particles, the resulting energy and momentum turns out to be conserved as is shown by calculations in [5, page 93].

The experiments show that in individual quantum processes at high energies the local energy and momentum conservation laws and conservation laws for the lepton and barion numbers are well observed. But the same is not true at small energies at least on account of ambiguity correlation [7,14]. Nevertheless, the idea of global (not only local) energy conservation law is invisibly present in all quantum mechanics, it is by no means a new one. From a physical viewpoint, it simply means that in steady-state solutions with fixed discrete energies, the velocity of a particle reflected at the wall is equal to that of the impinging one. If the particle speed decreases upon each reflection, this corresponds to the "crematorium" solution, in case it increases we face the "maternity home" alternative.

The "crematorium" solution should not be confused with the familiar phenomenon of particles decay— it is an absolutely new and very slow process taking place at small energies. It possesses no analogs in conventional quantum physics.

The "maternity home" solution (3) has been proved by reliable experimental data for any small cavity in a metal or ceramics-made sample, or likewise a water bubble with enclosed free particles and can be viewed as a well. This can explain both sonoluminescence and the emission of heat in nickel, palladium and ceramics. The theory allows for the samples to crack because of the pressure exerted on their walls due to energy growth, the energy generation being immense in the installations of Dr.Y.S.Potapov and J.Griggs. It would be extremely helpful to create an electrically isolated system emitting great amounts of heat in order to measure its charge, which is expected to vary in the course of energy generation. This would serve as an additional proof of the picture of the phenomena described above.

Thus the excess energy is taken from the vacuum, but this does not occur for nothing because in the neighboring wells some part of the matter would disappear. In other words, one is under the impression that a new mechanism for the direct conversion of matter into energy has been discovered. This energetic phenomenon is entirely pollution-free and a thousand times more effective then that of nuclear reactions. It is for the future to prove it.

Now let's take a bit of philosophy. The Local Energy Conservation Law (LECL) in individual processes follows directly from Newton's equations under the condition of uniformity of time. It would be naive to think that his local definition will remain unchanged. The trend in modern physics now is to treat the LECL, especially in theory, as a conclusion of secondary importance from the motion equation (integrals of motion). Some physics confine LECL within the limits of the first law of thermodynamics others as D. Blokhintsev maintain that "it is highly probable that the development of new theory will make LECL change its form" [15].

F.Engels wrote in "Nature Dialectics," "...no physicist regards essentially the LECL as an eternal (ever-lasting) absolute law of Nature, the law of spontaneous transformation of matter motion forms and the quantitative stability of this motion throughout all its transformations." But many research workers are of a different opinion as M.F. Bronstein [16] who wrote; "The ECL is one of the fundamental laws of Newtonian mechanics. Yet, Newton himself had never ascribed to his law the uniform character, which it possesses in reality. The reasons for such erroneous treatment of the ECL on Newton's part are extremely interesting...."

The idea to treat the ECL in quantum mechanics equally with the second law of thermodynamics as a static law being true only in average cases and unsuitable to individual acts, goes back to [15] E. Schrödinger , and later to N. Bohr, H. Kramers, I. Slater and G. Gamov. L.Landau had called it "a beautiful Bohr's idea" [15]. Yet, later it was rejected by the authors themselves. It should be noted that this idea did not follow from the quantum theory equations. But the brilliant idea still remains one, even being rejected by the person to whom it had occurred. In fact, it may simply turn out to be premature. Eventually, all the cosmologist's dream [may come true] of having a process explaining why throughout the entire Universe there are some places where energy emerges, being extinguished in the others. It is interesting that solution 3 gives one an opportunity to set a very small initial fluctuation, which then will accumulate energy and turn into a particle.

One has to accept the truth regardless of it's source. Therefore, I will conclude with the words of F.Engels, "But when the solar system completes its life-path and shares the fate of everything finite, when it falls victim to death. What then? Thus we come to the conclusion that the heat emitted into world space should have an opportunity by some miraculous ways which it will be the task of future science to define, to turn into some other form of motion, in which it can accumulate again and start functioning. In this case the main difficulty becomes obsolete, the one obstructing the reverse change of dead suns into a red hot nebula."

One can expect that having read this paper some highbrow theoreticians will assume the attitude of persons being witness to some childish tactlessness. But in the course of physics' development, it was experimentation that had always been the main judge.

I'd like to express my gratitude to N.V. Famina, the attractive translator of the article. I am equally thankful to Drs.. Y. A. Boichenko, O. I. Kasakov, I . Y. Kulikov, F.Mair, and Yu. G. Rudoy for taking part in the discussion and practical help in my work.

New Energy Times Archive

References

1. P.Hagelstein, "A plethora of miracles, " *"Cold Fusion,"* [E. Mallove, editor], vol. l, no. 3, p. 22, 1994.
2. J.Schwinger, "Cold Fusion: Does it have a future?" *"Cold Fusion,"* {E. Mallove, editor], vol.l, no.l, p.l4, 1354
3. J.Rothwell, E.Mallove, "The Hydrosonic Pump: An excess energy device?" *"Cold Fusion,"* [E. Mallove, editor] vol.l, No.2, p.26, 1994.
4. L.G.Sapogin, "Deuteron interaction in unitary quantum theory" and "On the mechanisms of cold nuclear fusion," *Proceedings: Fourth International Conference on Cold Fusion*.Vol.4:Theory and special topics papers, TR-l04188-V4. July 1994 (Hawaii).
5. L.G.Sapogin, "Deuterium interaction in unitary quantum theory," "On the mechanism of cold nuclear fusion," *Cold Fusion Source Book: International Symposium on Cold Fusion and Advanced Energy Sources*, Belarusian State University, Minsk, Belarus, May 24-26, 1994.
6. L.G.Sapogin, "Unitary Field and Quantum Mechanics," Investigation of systems. (in Russian, Vladivostok, Academy of Science), No. 2, p. 54, (1973).
7. L.G.Sapogin. "On Unitary Quantum Mechanics," *Il Nuovo Cimento*, vol. 53A, No. 2, p. 251 (l979).
8. L.G.Sapogin, "An Unitary Quantum Field theory," *Annales de la Fondation Louis de Broglie*, vol. 5, no.4, 285 (1980).
9. L.G. Sapogin, "A Statistical Theory of Measurements in Unitary Quantum Mechanics, " *Il Nuovo Cimento*, Vol. 70B, no.1, p.80 (1982).
10. L.G. Sapogin, "A Statistical Theory of the Detector in Unitary Quantum Mechanics," *Il Nuovo Cimento*, vol. 71B. no.3, p. 246 (1982).
11. V.A.Boichenko, L.G. Sapogin, "On the Equation of the Unitary Quantum Theory," *Annales de la Fondation Louis de Broglie*, vol. 5, no. 3, p.221 (1984).
12. L.G. Sapogin, V.A.Boichenko, "On the Solution of One Nonlinear Equation," *Il Nuovo Cimento*, vol. 1&2B, no.4, p.433 (1588).
13. L. a. Sapogin, V.A.Boichenko. "On the Charge and *Mass* of Particles in Unitary Quantum Theory." Nuovo Cimento.vol.104A,No.10, p.l483 (lSgl).
14. L.G.Sapogin, "Clear-cut picture of micro worlds," *Technic for the Young* (in Russian), No.l, p.41 (1583).
15. D.Blokhintsev, Collection of scientific methodological works in physics, (in Russian), State University of Moscow,1993.
16. M.Bronshtein., The matter structure. (in Russian). Moscow,1935.

An over-unity solid-state electrical device?

The Magnetic Resonance Amplifier Controversy Continues...

"Cold fusion" researchers are comfortable with the concept of excess energy in experiments that entail hydrogen isotopes in contact with metals and other materials. However, these same pioneering scientists may dismiss reports of excess energy production in solid-state or rotary devices that incorporate "nothing more than" permanent magnets, electrical coils, capacitors, and piezoelectric materials.

There is increasing information that at least *some* of these so-called "New Energy" devices, might be exhibiting true "over-unity" phenomena. The spectacular reports from Japan [see *Infinite Energy*, Vol 1., No.1, pp. 48-49] that credible corporate and university researchers there are developing excess energy permanent magnet motors, give new impetus to workers in the field—and should prompt "cold fusion" pioneers to consider these reports seriously.

As this issue of *IE* went to press, Bertil Werjefelt of PolyTech (USA) in Hawaii, was preparing a demonstration test of a self-sustaining motor-generator combination—of the type he discussed in detail at MIT Cold Fusion Day last January. His experimental program over the past decade leaves little doubt in his mind that he has seen "profound over-unity effects" — in one case 160 watts input, 450 watts ouput. Werjefelt considers cold fusion phenomena and excess energy magnetic machines to be intimately related via magnetic spin interactions at the atomic and nuclear level. At ICCF5, Professor Jaques Vigier gave his support to this general theoretical insight.

Now we come to the matter at hand, the continuing controversy since last December about whether a so-called "Magnetic Resonance Amplifier" (MRA), is a true over-unity device, or whether the measurements of its input-output power might be in error. Giving added support to the validity of the MRA, are positive evaluations from three highly-credible engineering laboratories—both university and corporate— in the Atlanta, Georgia area. Unfortunately, these organizations do not wish to formally disclose their results at this time, pending a satifactory explanation for the phenomenon. Consequently, we present here both sides of the controversy via the originators of the MRA and investigators at EarthTech, Inc. of Austin, Texas, who evaluate the MRA negatively. *IE* will continue to follow this intriguing controversy until it is resolved.

How We Discovered the Magnetic Resonance Amplifier (MRA)

by Norman Wootan, P.O. Box 141049, Dallas, Texas 75214

After reading the first issue of *Infinite Energy*, I must commend the editors on an excellent start up of this new and needed publication that I feel will help spread information on the little understood "free energy" research efforts. I wish to contribute to your effort by submitting the MRA (Magnetic Resonance Amplifier) story, from my perspective, so your readers can appreciate how this novel device came into existence.

In the Dallas Metro-plex we have the Keely-Net BBS owned and operated by Jerry Decker (sysop) through which researchers in alternative energy, radionics, medicine, gravitics, and many other subject have an open forum in which we exchange freely our ideas and opinions on the various topics currently being discussed. It has proven to be a very valuable tool to bring together like-minds and talents regardless of geographical location. This is the world of the "computer super highway" at work, for we are tied into the Internet and Compuserve for dissemination of information and for a research data base. Jerry also organized and holds a Vanguard Science Group meeting each month which gives us an opportunity to meet face to face the personalities with whom we converse on the net on a day-to day basis. Through this Keely-Net and Vanguard Science Group interaction, I met Joel McClain about a year ago and we began to exchange ideas on the "sacred geometry" behind how everything in nature seems to work. I was actively researching tetrahedron and nested tetrahedron-style coils designed to produce "scalar effects" inherent in their unique design. Also, I was researching the Hydrosonic Pump anomalous heat output phenomenon, when Joel became interested in my observation of caduceus standing wave patterns about the rotor of the pump unit which has a clear quartz housing to enable observation of the internal dynamics. Now is where the "Celestine Prophecy" comes into play.

Joel had been studying the

New Energy Times Archive

"sacred geometry" and had written several excellent files one being PHI & RES dealing with the little known (in modern physics) phi or Fibonacci Series derived from his study of works such as "Secrets of the Great Pyramids" by Peter Tomkins and "Pyramid Energy," by Dean and Mary Hardy. I too had been studying the great tetrahedrons and was intrigued by Richard Hoagland's work on the Mars/Earth connection dealing with points on the planets.

After I had built several of these nested tetrahedron resonant coils for the purpose of inducing "virtual rotation" within the structure to possibly overcome gravity, I showed one to Joel one day and he exclaimed after turning the nested tet 45 degrees, "a cube is a nested tet." Our theory is based on the power inherent in the nested tet. Back in 1987, I had been researching a fusion idea based on the works of Nicola Tesla. Therefore, when Pons and Fleischmann made their famous announcement to the world, I just had to attend the American Chemical Society Conference here in Dallas in the spring of 1989. After the conference (22 April 1989), I submitted a Patent Search Document (enclosed) and found no "prior art" which dealt with electrostatic resonance within the crystalline lattice structure of the Cold Fusion Cell cathode material. If you look at the Periodic Table, you will see that palladium and titanium both have a face cubic structure which is a "nested tetrahedron" lattice.

An interesting turn of events occurred when Hal Fox published an article (*New Energy News*) on the famous Neiper Ring circuit, which displays an anti-gravity or weight loss effect. Having a copy of Hans Neiper's book, "Revolutions in Medicine and Technology," I gave Joel the circuit diagram and he successfully built and verified that the circuit does display the weight loss effect reported. Since we were both in tune with the power within the nested tetrahedron, we quickly found that the crystalline components of the transistors in the circuit were face-cubic material and were in fact entering into self-resonance which causes the anti-gravitic effect. What we were seeing was the "virtual rotation" of energy within the crystalline lattice of the silicon and germanium, which directly affects the electron spin state of the atomic structure. Joel "theorized," based on Maxwell and Whittaker's works, that gravity is a quadrupole effect and not a force, as accepted physics now believes, so if we affect the electron spin state of the atomic structure, we cancel the gravitic effect in the face cubic (nested tetrahedron) material.

Now things really get interesting, for Joel had been exploring the anomalous energy output from a barium titanate transducer, which is an area of physics that very few have dealt with except the "Star Wars" [SDI] boys dealing with NLO (non-linear optics) and Phase Conjugate Mirror (PCM). Joel was holding in one hand a barium titanate crystal and in the other a permanent magnet, and exclaimed that there had to be a way to unlock the power locked in these two devices in the form of free electrons. Having read all of Tom Bearden's work on PCM and "scalar" technology, we proceeded to wind coils on permanent magnets and place them into a series resonant circuit with two components, one being a saturated magnet core transformer and the other a highly non-linear piezoelectric crystal. The results of our experimentation was that by supplying a three octave resonant relationship (a lá John Worrels Keely) between the piezoelectric crystal and the magnetic transformer, we got our first indications of an over-unity output in the form of useful electrical energy.

This first over-unity indication occurred on 11 Dec.1994 and on 12 Dec. the File, MRA.ASC was placed into public domain on the Keely-Net for others to duplicate and assist in our research of this new-found phenomenon. On 13 Dec., Bill Beaty of Seattle, Washington posted this file on Internet and Compuserve, so as to get the widest possible dissemination so that the technology could not possibly be suppressed in any way or be declared by interested government agencies as being classified in the "interest of national security." Now we were braced for the storm of "flames" from the Internet and did not have to wait very long for the arrows to start flying! In a few days, Joel had not only posted the MRA.ASC file but had also wrote and posted MRA1.ASC and RULE9.ASC, which gave our theory behind the anomalous energy output. I guess the posing of a theory from two "hayseeds" from Texas, who didn't have Ph.D. behind their names, just infuriated the physics world . The emotional outpouring of criticism from some of the most notable physicists in the country was a sight to behold. There were several noted scientists that were more understanding and accepting of the fact that science does not make the rules, mother nature does. After building numerous MRA devices of varying configurations using different magnet material, we found the barium ferrite and the strontium ferrite to perform best as the transformer core.We experimented with various turns ratios and wire size and types to try optimizing the output. Stranded type wire worked better then solid wires and the Phi ratio windings (1.618) Fibonacci Series 1, 2,3,5,8,13,21 etc. combinations were superior in performance.

Next we had to get independent evaluation of the new-found technology. Therefore, three devices were sent out to be evaluated by Tom Bearden, Walter Rosenthal and Hal Puthoff The 50% of unity report submitted by Hal Puthoff was based on the insertion of a resistor in to the primary of a highly non-linear circuit in order to make it linear, so as to arrive at an input current measurement to determine total input power. This was an unfortunate event for both Dr. Puthoff and our effort to get confirmation of over-unity. This event was caused by the fundamental lack of understanding of non-linear series resonant circuits containing two very non-linear components in combination, which yields circuit behavior not found in any text book. A study of series resonant circuits clearly outlines the effect in which added lump resistance flattens the resonant curve peak out and broadens the bandwidth. Our problem is that the MRA is a highly tuned circuit operating when at maximum gain, in the lossless region of ultra-high Q. We all were in that "learning curve," so all has been forgiven now that we have a better understanding of this highly unusual circuit.

Based on the published MRA article in the *New Energy News* by Hal Fox and the Internet posting of all MRA Tech Notes and bulletins, we quickly got several very important confirmations, one of which was by Gregory Hodowanec of Cosmology Research fame. Greg quickly picked up on the MRA Technology and cranked out his MiniMRA version, clearly demonstrating the over-unity that we had found. Engineers at several large corporations contacted us with similar results, so we knew that this was all real and not a dream. Numerous confirmations came in on the Keely-Net and Internet. Therefore, we knew we were on solid ground.

The subsequent test by other facilities, which I cannot name (these organizations wish for now to remain unidentified) got solid 10:1, 10:1, and 18:1 over-unity results using the very best testing and diagnostic electronic equipment available on the MiniMRA,

New Energy Times Archive

as designed and built by Greg. Joel and I had journeyed to Atlanta, Georgia back in February to do a demonstration for a group of possible interested investors headed by Robert Taylor, a very prominent Contractor and Builder. As a result of our meeting and mutual understanding, as to the magnitude of this technology and its ramifications, we joined as a team with Bob, for he had the necessary capital and business savvy to pursue the Patent process. After interviews with several Patent Attorneys who exclaimed that our MRA would not work, for it violated the "laws of physics," we found, through Hal Fox, Dr. Robert Bass who is very prominent in the Cold Fusion arena Dr. Bass said it was an honor to get the opportunity to write the patent on this new and very promising technology. As a result of recent tests during which clear overunity results were achieved by several prominent research facilities, Dr. Hal Puthoff and Scott Little at the Institute for Advanced Studies in Austin, Texas have rejoined the testing effort now that a better understanding of the true nature of this highly unusual combination of circuit elements is known. In the very near future, after we get several documented confirmations of the overunity performance of the MRA, we will be negotiating license agreements with several very large corporations for the commercial development of this technology, now that we have the all-important "Patent Applied For" numbers in hand.

Evaluation of Magnetic Resonance Amplifier (MRA)

Institute for Advanced Studies / EarthTech International, Inc.
H. E. Puthoff and Scott Little
20 January 1995

ABSTRACT

An MRA device provided by Joel McClain and Norman Wootan was tested for power efficiency. The MRA is essentially a power converter, driven by an audio frequency AC voltage and producing a DC output. Our tests included meter measurements, made in the manner employed by McClain and Wootan, and digital oscilloscope measurements, which provided high resolution recording of input voltage and current traces. Our meter measurements duplicated the results reported by McClain and Wootan, which would appear to indicate over-unity (>100% efficiency) performance at certain frequencies, but only because the reactive behavior of the system is not properly taken into account by this measurement procedure. The digital oscilloscope measurements, which correctly account for the effects of circuit reactance, yielded a nearly constant 50% efficiency at all frequencies.

Introduction:

The MRA device we tested consisted of a piezoelectric transducer connected in series with the primary of a specially-constructed hand-wound transformer. The transformer has a ferrite core and the secondary is connected to a full-wave bridge whose output is connected to a load.

McClain and Wootan computed AC input power by determining an equivalent resistance R of the MEA, and then substituting that value R, and the closed-circuit MRA input voltage V, into V^2/R to calculate an input power. They determined this equivalent resistance by substituting a decade resistance box in place of the the MRA to find the resistance that would yield the same connected-circuit driving voltage. (Such a procedure is appropriate for purely resistive loads.)

In their most recent tests McClain and Wootan used a small DC motor as a load for the MRA. We used the motor initially to confirm proper operation of our MRA test bed, but replaced it with a 130 ohm resistor to eliminate commutation noise for the tests described below. We also attached a 30,000 microfarad filter capacitor across the load resistor to smooth out the DC to ensure accurate measurement with common digital meters. We used two Micronta 22-185A meters, one in series with the load to measure current and one connected across the load and the other meter to measure total voltage delivered to the load and current meter. Total output power is the product of these two quantities.

To generate the 34 kHz signal needed to drive the MRA we used a TEK FG504 Signal Generator amplified with a Pioneer H100, a modern solid-state 160-watt audio power amplifier without output transformers. To duplicate the performance of McClain and Wootan's Radio Shack MPA-45, 35-watt amplifier, we had to add series L (34 microhenries) and R (11.68 ohms) to our amplifier. Without the series R we only observed a 0.10 volt droop when driving the MRA at resonance (McClain and Wootan's amplifier exhibited a 1.58 volt droop under this loading). Without the series L the anomalous effects were still present but substantially lower in magnitude than those observed by McClain and Wootan. With our amplifier thus modified by the addition of these elements, we have duplicated the McClain-Wootan driver amplifier setup precisely.

We used a LeCroy ScopeStation 140 100MHz digital oscilloscope with simultaneous sampling on 2 channels to measure MRA input voltage and current. Current was sensed as the voltage drop across the 11.68 ohm resistor placed in series with the amplifier output. This resistor was made by placing two 22 ohm, 2 watt carbon comp resistors in parallel to provide the desired resistance with a minimal inductance.

Procedure:

We conducted a series of measurements at different frequencies. At all times the MRA was connected to the 130 ohm load resistor. At each frequency we made the following measurements with the MRA connected to the AC signal source:

f	source frequency (measured with a Fluke 87)
V_{inMRA}	voltage across the source terminals with the MRA connected(Fluke 87)
$V_{out\ load}$	DC voltage across the 130 ohm resistor and current meter (Micronta)
$I_{out\ ohm}$	the DC current through the 130 load resistor
$V_{in\ age}$	digital recording of the input voltage trace covering about 4 cycles
$I_{in\ rent}$	digital recording of the input current trace simultaneous with Vin

At each frequency we also disconnected the MRA and measured:

$V_{open\ source}$	the open circuit voltage of the

We than connected a decade resistance box across the source terminals and by trial-and-error determined:

$R_{equiv\ the}$	the resistance required to produce same driving voltage as with the MRA connected

Results:

The following table shows these measured

New Energy Times Archive

f	V_{inMRA}	V_{open}	R_{equiv}	V_{out}	I_{out}
33.84 (kHz)	21.06	23.36	140	18.68	.1324
33.56	23.84	24.04	1900	15.02	.1068
33 34	24.20	24.10	negative	9.75	0.0696
32.47	24.58	24.26	negative	5.28	0.0377

quantities for four different frequencies, beginning at resonance and then decreasing.

The first entry in the table is at resonance and is characterized by the highest Vout value. The second entry has Vout at approximately 85% of the maximum value as suggested by McClain and Wootan. The digital data for Vin and Iin are not presented in this table in the interest of brevity. The several pages of digital data generated for each line in this table are, however, available upon request.

The next table shows the results of the power calculations both by the V^2/Requiv method used by McClain and Wootan, and by the averaging of Vin times Iin using the digitized data. Also tabulated are efficiency figures for each method (i.e. output power divided by input power).

f	DC_{output}	V^2/R_{equiv}	avg $V_{in}*I_{in}$	Mc-Weff	$V_{in}*I_{in}$ eff
33.84 (kHz)	2.473	3.168	4.566	0.78	0.54
33.56	1.604	0.299	3.265	5.36	0.49
33 34	0.679	negative	1.467	negative	0.46
32.47	0.199	negative	0.401	negative	0.50

The figures in columns 2 - 4 are in watts. The last two columns contain ratios. The column labeled "Mc-W eff" is the power efficiency calculated by dividing the DC output by the McClain-Wootan input power V^2/Requiv.

Discussion:

The second row in the table shows the condition that McClain and Wootan interpreted as over-unity performance (e.g., an efficiency of 5.36). The problem lies in the value of l900 ohms for Requiv. This value was obtained because of the small voltage change between open- and closed-circuit conditions (24.04 to 23.84) measured at that frequency. Note that at even lower frequencies, the source voltage was observed to actually increase above the open circuit voltage when the MRA was connected...a condition that McClain and Wootan also observed but did not attempt to analyze. At first glance this could be interpreted as evidence that the MRA was now feeding power to the source.

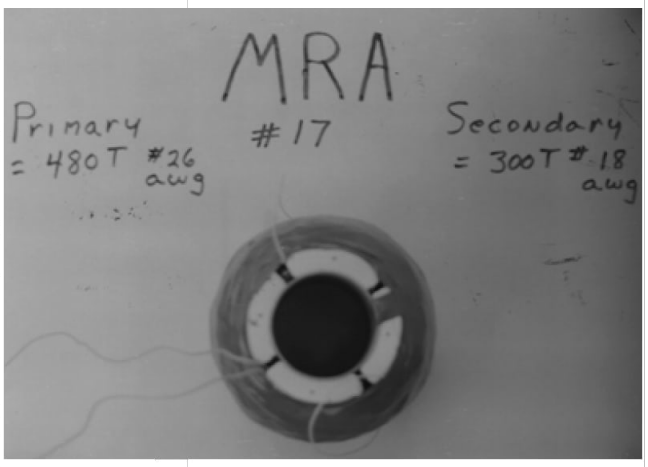
However, this behavior is exactly what is predicted by classical AC circuit analysis when a load with a net capacitive reactance is driven by a source that has a net inductive reactance. Since the MRA is essentially a series LC circuit, at frequencies below resonance it will exhibit a net capacitive reactance. The audio amplifier used by McClain and Wootan has an output transformer which, at the MRA operating frequency (substantially higher than the middle of the audio range), will exhibit a noticeable inductive reactance in its output impedance.

With such a combination of reactances one cannot using only the magnitudes of voltage and current, determine the actual power being transferred to the MRA device. In particular, the Requiv method fails as one detunes from resonance because it ignores the effect of reactance. Such reactance creates a phase shift between voltage and current, a fact well-known in the electric power industry as "power factor." For example, if both voltage and current are sinusoids, true power is given by V*I*cos(A) where A is the phase angle between the voltage and current waveforms. An equivalent method, which is more general because it is applicable to any waveform, is to average the product of the voltage and current waveforms over an integer number of cycles. This is the method we used to obtain the values in the second table in the column "avg $V_{in}*I_{in}$".

Conclusion:

Based on the results of our experimentation and analysis we find that the MRA device provided by McClain and Wootan does not produce over-unity-efficiency results. The MRA circuit behaves instead as one would expect of a loaded transformer with a series capacitor in the primary circuit. When the MRA is de-tuned from resonance to frequencies slightly below resonance, the observed changes may give the impression that the MRA then draws unusually little power from the source while nonetheless maintaining a healthy output. This impression is false. True power measurements show that the MRA continues to draw about twice as much power from the source as it delivers to the load.

MRA inventors, Joel McLain (L) and Norman Wootan



MRA #17, top view

Idea:

Write a letter about cold fusion and new energy to your Congressman, Senator, President, favorite Presidential Candidate, or Prime Minister.

New Energy Times Archive

Cold Fusion in 2001 and Beyond: Lessons from High Tech

by Dr. Robert W. Horst

Dr. Horst has the title of Technical Director at a Tandem Computers, Inc. He has 19 years experience in high-technology and holds 22 U.S. patents.

Results of recent experiments have given new hope that the phenomenon known as "cold fusion" may indeed be a revolutionary new power source. While the cause of the so-called excess heat may or may not be due to fusion, it is becoming increasingly clear that the magnitude of the heat far surpasses amounts that could be released through chemical means. Assuming that the many positive results cannot simply be explained by experimental error, we may be about to witness a new age of innovation in energy production unlike anything seen in modern times.

The slow rate of change in energy technology sharply contrasts with the breakneck rate of change in high-tech industries such as electronics and biotechnology. In electronics, products often are obsolete within a year of introduction. New product enhancements are fueled by the exponential rate of change of the basic silicon technology that doubles memory capacity and processing power every few years. Such rapid change forces high-tech companies to understand change and to develop strategies to plan for change.

The discovery of an entirely new type of energy technology could soon make the energy industry resemble high-tech in the rate of change. Already, with only a few laboratories devoting serious funds to cold fusion research, we have seen a wide range of techniques producing excess energy. Once the engineering phase begins in earnest, we will see a bewildering assortment of new techniques and devices that take advantage of the unique characteristics of cold fusion power. As the rate of change accelerates, many important lessons can be learned from past experience in high-tech industries.

Lesson 1: Superior technology may lose to bigger research investment

In electronics, there are countless examples of new technologies that were inherently superior to existing technologies, but could never overtake the existing technology due to the difference in the funds available for research and development. In semiconductor technology, once silicon CMOS technology gained acceptance, the amount of money spent to enhance it was enormous compared to the amount anyone could afford for a competing technology. Gallium arsenide, Josephson junctions, and new silicon technologies had certain advantages, but companies pioneering these technologies were hopelessly overspent. A similar story can be told for the Betamax versus VHS video technology war that was won by VHS despite the technical superiority of Betamax.

The lesson for cold fusion is to avoid direct competition with well established industries that have already won the war for market share. For instance, a proposed use for cold fusion is for a home water heater. Even if a cold fusion water heater turns out to be far superior to a gas water heater in fuel costs, market acceptance will be slow because the gas water heater has many advantages. Gas water heaters currently have most of the market share and enjoy the economies of scale from manufacturing in large volumes. The infrastructure for delivering the gas is already in place, and most water heaters work reliably for years with minimal maintenance. Current costs for hot water are low for most families, and there is little incentive to buy a relatively expensive, unproven, technology whose investment would take years to pay back through lower utility bills. [*Editor's comment*: Ah, but what if the water heater, like the Potapov device, is cheap *and* proven?!]

Lesson 2: Bootstrap by appealing to early adopters

With a new technology, it is important to appeal to a class of early adopters who enjoy experimenting with new products. These are the people who spend their free time browsing through gadget catalogs, or who want the flashiest new software for their personal computers. Who would have thought there would be a huge market for programs that make flying toasters appear on a computer screen? Yet frivolous consumer products are a way for small companies to become large companies and push the state of the art in technology.

So what is the cold-fusion equivalent of the flying-toaster screen saver? It might be a perpetual hand warmer, or a no-cords-attached Christmas tree bulb. Or perhaps it will be something more practical like a cold fusion pool/spa heater. While the pool heater is essentially the same technology as the home water heater, the market is completely different. Just as the swimming pool heater was one of the first uses for solar power, it also may be a good application for early adopters of cold fusion power. The people owning pools are likely to be affluent enough to experiment with a new technology, yet still be sensitive to the high cost of keeping a pool heated. The cold fusion pool heater could be a way to ramp production capacity and gain experience before going after the home water heater market.

Lesson 3: The big returns are in areas with no suitable alternative

Long term, the biggest impact of a new technology is in inventing whole new product categories that were not previously possible. At the time the transistor was invented, who would have predicted the large markets for fax machines, cellular telephones, or portable computers? The new markets develop through the marriage of the new technology, an innovative idea, and someone's willingness to take the financial risk to develop the new market.

By definition, it is difficult to predict the unknown new markets that could develop around cold fusion, but we can hazard a few guesses. Currently there is no energy source that can provide continuous portable energy over large periods of time. A portable energy source would be especially useful for powering boats, where it is often inconvenient (or impossible) to refuel. Such a market might start by marketing a small emergency motor that could be used when primary fuel is low, or for sailboats in unfavorable wind conditions. The industry could grow to provide primary power to a new type of non-polluting power boat with nearly unlimited range.

Another near-term use for a portable energy source would be for household power tools. Nearly anything that currently uses gasoline is a candidate due to the inconvenience, mess, and danger of handling gasoline. For instance, a cold-fusion lawn mower would be an immediate hit because it would be so much more convenient than a gasoline powered mower. Developing small

New Energy Times Archive

cold fusion engines for household applications may be a way to learn and evolve the technology until it is ready for use in automobiles.

Longer term, a source of very cheap energy could revolutionize transportation. Most vehicles today are still dependent on roads similar to the ones built by the Romans centuries ago. If energy ever becomes cheap enough, we can finally free ourselves of the need to pave over the countryside, and instead use whole new classes of planes, helicopters or other new vehicles that are not gravity-impaired like the automobile.

Lesson 4: Don't forget the supporting technologies

High tech is full of examples of new technologies whose progress was impeded by lack of appropriate supporting technology. For instance, superconductors have been slow to find applications due to the lack of good refrigerators to keep the devices operating below their critical temperature. A small company pioneering the use of superconductors in electronics had to design their own cryogenic refrigerator to allow practical use of high-temperature superconductors for use in military communications systems. In the computer industry, the introduction of new hardware technology has often been delayed while the supporting software was being completed.

The supporting technology for cold fusion may include the development of new engines, electric generators, and heat removal devices. To convert the heat into mechanical energy, cold fusion engines might work on many different principles. The techniques might resemble external combustion (steam) engines, or electric motors powered by thermocouples. Developing an efficient engine may be the limiting factor in applying cold fusion devices in many markets. For some potential applications, the biggest problem to overcome may be, ironically, excess heat removal. If thermocouples are used to generate electricity, their low efficiency will mean that nearly ten times as much heat must be removed as is actually converted to electricity. In some devices, the excess heat may be put to good use, but for many portable power generation applications, removal of the excess heat may be problematic.

Lesson 5: Rely on patents for protection, not income

The role of patents in a fast-changing industry is often more for protection against costly litigation than as a source of licensing income. Many high-tech companies accumulate patent portfolios, then use them as trading chips in negotiating cross-license agreements. In an expanding new market, a company is limited by its ability to grow and produce new products, not by the size of the market. Patents on the early ideas may not be as valuable as one might think, because the industry may move to new ideas before the original patents have issued. Patents on the first point-contact transistor would have had little value as the industry quickly changed to bipolar transistors and then the MOS transistors used in today's electronic systems.

There have been complaints about the inability to obtain patents on early cold fusion concepts. In order to obtain a patent, the inventor must prove that the device is new, useful, and is not an obvious extension of previous work. The problem with cold fusion devices is to prove that they are useful—that they really work. It should not be necessary for the cold-fusion pioneers to obtain patents before useful devices are produced. If the ideas are successful, then the products will sell and the inventors will have no problems obtaining patents on those products. A few people have made money by filing for patents on high-tech inventions and waiting for others to trip over them like land mines, but most high-tech fortunes are made by producing and selling a superior product. The same principle should hold true for cold fusion.

Lesson 6: It's never easy

Unfortunately, the history of high tech is filled with examples of promising new technologies that never fulfilled their initial promise. Bubble memories were going to replace disk drives, but were eventually abandoned. Other technologies, such as inexpensive flat-panel displays, have been on the verge of commercial production for many years. New technologies may run into problems with reliability or manufacturability, or they may never reach production due to lack of investment funds or a shift in market demand.

Cold fusion has many hurdles to overcome before its success is assured. The phenomenon must be well-understood and 100% reproducible in order to optimize the efficiency and make it economically viable. The amount of heat must be controllable, and devices must be proven to be safe and reliable. Companies also need to prove that devices can be manufactured at very low costs. All of these concerns are potential stumbling blocks that could delay the introduction of the first cold fusion appliances.

Lesson 7: Expect the unexpected

If the many pitfalls can be avoided, cold fusion could touch off a new golden era of innovation, and may have a major impact on society as early as 2001. The success of the first few products will start a feedback cycle allowing companies to invest profits in research and development to advance the technology. Eventually, nearly every device that uses power, from large generators to small appliances, may be redesigned to take advantage of this new power source.

The first applications of cold fusion energy may not be the areas usually cited—water heaters, home power generators, and automobiles. It is more likely that the first uses will be aimed at consumers, and will range from frivolous to serious. These applications may include swimming pool heaters, boat motors, lawn mowers, and hundreds of other novel applications where gasoline and electric power are not good choices. As the technology matures, it will move into mainstream applications and begin to replace fossil fuels for transportation and home heating.

If there is one lesson to be learned from high tech, it is that no one can predict where an exciting new technology will lead. The best we can do is to hang on and enjoy the ride.

Spread the Message!

Order
Bulk Copies
of
INFINITE ENERGY
today.

Minimum Order for Discount:
25 copies
U.S./Canada Rate $100 per 25 copies
Other Foreign: $140 per 25 copies
(Plus shipping charges.)

New Energy Times Archive

CALENDAR

MIT Cold Fusion Day
January 21, 1995
Cambridge, MA

American Chemical Society
April 3, 1995
Cold Fusion Poster Session
Anaheim, California

ICCF5 – Fifth International Conference on Cold Fusion
April 9-13, 1995
Monte Carlo, Monaco

Society for Scientific Exploration
Annual Meeting
June 15-17, 1995
Huntington Beach, CA

Low-energy Transmutation Meeting (Private) At Texas A&M University
June 19, 1995

International Alternative Fuels Conference and Trade Show
June 28-30, 1995
Milwaukee, Wisconsin

The Second International Conference on New Energy Systems and Conversions
July 31-August 4, 1995
Istanbul, Turkey

The 2nd World Hydrogen Summit
September 28
-October 1, 1995
Montreal, Quebec, Canada

Third Russian Conference on Cold Fusion and Nuclear Transmutation
October 1—8, 1995
Sochi, Russia

Alternative Fuels Conference and Exposition — Sponsored by SAE
December 6-8, 1995
San Diego, California

ICCF6—Sixth International Conference on Cold Fusion
Spring or Summer/1996
Hokkaido, Japan

1996 International World Energy System Conference
June 19-21, 1996
Toronto, Canada

JOURNAL OF SCIENTIFIC EXPLORATION

ISSN 0892-3310

An Invitation to Explore the Frontiers of Knowledge

As science has developed, it has become increasingly specialized. While this has led to enormous progress in many areas, it has also excluded investigation of anomalous phenomena which do not neatly fit into established categories of mainstream research. The international Journal of Scientific Exploration was established in 1987 to provide an unbiased professional forum for research and discussion of topics outside the conventional disciplines of science. Research articles are selected for publication on the basis of scholarship, as determined by peer review, and can be either supportive of, critical of, or neutral toward the reality of any anomalous phenomenon. Published topics have included anomalies in physics and astronomy, psi-phenomena, medicine, UFO's, astrological claims, cryptozoology, reincarnation investigations, etc. The goal of the journal is to make available high quality reports, reviews and commentary for use by researchers, teachers, students, and the general public.

JSE is the official publication of the International Society for Scientific Exploration, whose membership is drawn primarily from professional Ph.D. and M.D. researchers in such fields as physics, astronomy, chemistry, biological sciences, engineering, and medicine. JSE is published quarterly. For further information contact:

JOURNAL OF SCIENTIFIC EXPLORATION
ERL 306,
Stanford University
Stanford, CA 94305 USA

Published quarterly by the Society for Scientific Exploration
Telephone: 415-593-8581
FAX: 415-595-4466

Annual Subscription Prices (four quarterly issues)
$35 - Special First-Time Personal (foreign add $5.00)
$45 - Regular Personal Renewal (foreign add $5.00)
$100 - Institutional (Institutions may request invoice)

Master Card and VISA are accepted (include number and expiration date)

Bulk Copies of Infinite Energy *Are* Available.

Fax: 603-224-5975

New Energy Times Archive

COMMENTARY

Proposal for Designing a Cold Fusion Reactor and its Commercialization ("Green Light")—March 1994

by Dr. Lev Sapogin, Professor, Head of the Physics Department
MADI Technical University, Moscow, Russia

Editor's note: This 1994 proposal is presented to show the seriousness with which Russian researchers are considering cold fusion.

1. A short review of the problem

Experts say that the present-day resources of hydrocarbon fossil fuels will be exhausted by 2025 and then the world will face a severe energy crisis. In fact, conventional nuclear reactors could solve this problem, since the existing thorium and uranium deposits could last for billions of years. But from an ecological point of view, the current varieties of classic nuclear-fission reactors are like "delayed-action mines" in warfare.

Theoretically, thermonuclear fusion reactions based on deuterium and lithium could also solve the energy problem, because the natural deposits of deuterium and lithium are practically unlimited. In theory, the nuclear fusion problem could be solved with two classical approaches: either by means of plasma fusion in installations of the "Tokamak" type or with the help of laser fusion. All the programmes for controllable nuclear fusion are based on heating and squeezing of the reacting material. Despite the progress achieved in this field, Dr. Alan Gibson, the head of the research in England, said that it would take at least 50 years to build the first demonstration model of the reactor. It should be noted that such a reactor would be extremely sophisticated, expensive, and harmful to ecology.

No classic approach to this problem has hitherto given any positive results and this, despite the billions of dollars spent and the enormous number of research workers and other personnel employed (physicists, engineers, managers, laboratory staff etc.). It is only natural that such a huge army of scientific workers should potentially antagonize any other alternative project of nuclear fusion. It has been noticed that the "creativity" of any scientific theory stands in direct proportion to the number of researchers employed and the money spent.

Such an alternative source of nuclear energy can be founded on the cold nuclear fusion (CNF) reaction. The possibility of CNF was theoretically predicted in 1983 by the author, L.G.Sapogin (of the USSR), on the basis of a unitary quantum theory (UQT). The reaction itself was experimentally confirmed in 1989 by M.Fleischmann and S.Pons in the US, where the two researchers were met with strong opposition. Indeed, proceeding from the assumptions of quantum mechanics, CNF is fundamentally "impossible" and this serves as a major argument for the CNF opponents.

Still, the numerous experiments carried out in many countries by different groups of scientific workers confirm the existence of the CNF reaction. Many researchers are of the opinion that we need "new physics" (e.g. in the German journal *Focus*, N 7, 1993) to explain the CNF phenomenon, the reaction itself being a challenge to theoretical physics.

The problem is that the experimental research on CNF is carried out nearly blindly, i.e. without a generally agreed-upon theory. This leads to inefficient use of costly experimental equipment, while important practical results are taking a very long time to be achieved.

The idea of UQT proposed and developed by L.G.Sapogin opens the way for experimental work based on knowledge of CNF mechanisms with a view of building CNF reactors. Also, mathematical and computerized models of particle interactions in operational environments may be immediately instrumental for the development of CNF reactors. The money invested in this research may yield important theoretical results, reduce the cost of experimentation, and considerably shorten the time required to cope with practical tasks.

All the programmes for controlled thermonuclear fusion are defined by the adjective "controllable," though in reality there is no control as such. For this reason the provided quantity of reaction material is made extremely small. For instance, a lithium deuteride ball is no more than 3-4 mm in diameter. In the direct approach being used, the fusion process is absolutely natural, because there are no means to influence this process in quantum mechanics. UQT provides us with such an opportunity. UQT equations show that the minimum distance to which the deuterons may approach each other depends greatly on the wave function phase. The future of the truly controllable nuclear fusion system is not in primitive squeezing and heating of the material, but in collision of small energy nuclei with fine adjustment of wave function phase. In principle, this can be achieved by applying the external controlling electromagnetic field upon the reacting system that contains quasi-fixed ordered deuterium atoms and free (unbound) deuterons. The same properties may also be manifested by the special geometry of atomic lattices. The diffraction scattering of deuteron flow in such lattices will result in deuteron automatic selection in accordance with their energy and phasing. In this case, the energy of colliding nuclei may be less than 1 eV.

Apparently, in the course of their electrochemical experimentation, M.Fleischmann and S.Pons discovered this ordered system and observed occasional incomplete phasing, which explained the experimental results.

In our future reactor models, in contrast with the existing ones, only a very small portion of all deuterons will react simultaneously, their automatic selection being carried out by phase correlations. This will lead to discharging of small quantities of energy in a prolonged period of time until the reacting light nuclei source is exhausted. Doubtless, that kind of nuclear fusion could rightfully be defined as "controllable."

But CNF is not the only way for mankind to solve its energy problem. UQT opens up an absolutely new energy generation mechanism, unknown to

New Energy Times Archive

the conventional quantum theory. This mechanism is entirely pollution-free. It is the one that explains the vast energy production in CNF. Today it has become experimentally known that only some small percentage of the produced heat is directly associated with nuclear reactions, the remaining source being hidden deep in the mysteries of the new physical process.

Similarly mysterious to science are the mechanisms of sonoluminescence and energy production in cavitation bubbles. These phenomena could be explained in UQT. We expect the proposed CNF reactor to be compact, simple to operate, inexpensive, and pollution-free. Apparently, the first reactors will be designed for house heating. The expected overall output of heat: 1 litre of deuterium or lithium-containing working substance will produce the same amount of heat as 1.5 tons of gasoline, the heating process itself being extended for two or three years.

If we manage to build a reactor based on entirely new heat production mechanisms, it is common water that could be effectively used to "fuel" it.

Prospectively, if the CNF reactor is built, its commercial properties may be even more attractive than those of the internal combustion engine, millions of which are produced every year. Therefore we have every reason to believe that the principle road to solving the energy crisis lies in the field of proposed controlled CNF ideas.

2. Theoretical basis of the project

Our CNF research is based on the UQT that L.G. Sapogin has been developing for the past 20 years. The main theoretical assumptions and experimental results have been published in such physics journals as *Ann. Fond. L. de Broglie* and *IlNuovo Cimento*. In UQT any elementary particle is a condensed clot of a some unitary field travelling in a packet of partial waves. Dispersion and a non-linear nature of the process spreads the wave packet periodically across space and assembles it; the envelope of the process coinciding with the de Broglie wave. The formalism of the theory amounts to a relativistically invariant system of 32 non-linear integral-differential equations whence follows, in its own system of reference, relativistic quantum mechanics in the form of Dirac's equation. On the other hand, Hamilton-Jacobi's relativistic mechanics follows strictly mathematically from the theory.

UQT, in contrast to quantum mechanics, is free of inner conflict and provides a fuller and finer description of physical reality. Being in agreement with the aggregate of experimental data, the theory also immediately provides an instrument for solving important theoretical issues. Thus, in 1991 on the basis of theory's equations, L.G.Sapogin managed to calculate the fine structure constant and electronic charge (experimental variation—0.3%), this being achieved for the first time in theoretical physics. All this gives us ground to believe that the principle assumptions of UQT are valid.

Quantum mechanics describes particle behavior by a wave function with the squared modules of which the density of probability of the particle's presence in a particular location is linked. As the phase does not affect the squared modules, it can produce, in theory, no effect on experiment results and is a "redundant" parameter of the theory. Therefore, the only parameter determining the possibility of a nuclear reaction is the energy of particles which must be on the order of several hundreds of keV, which corresponds to a temperature on the order of a billion degrees and thus forbids CNF.

UQT equations contain no "redundant" parameters and the wave function phase has a substantial effect on particle interaction. If, for instance, a wave packet arrives at a potential barrier in a phase when its amplitude is small enough, it crosses the barrier easily (which actually determines the mechanism of the "tunnel effect"). If the amplitude is high, non-linear interaction with the barrier results in reflection of the packet (the particle).

The minimum distance at which deuterons may approach each other depends not only on their energy but also on the phase of the wave functions at the moment of approach. The effect the phase produces on deuteron interaction leads to a theoretically threshold-less process of their merging, though the probability of the merging goes abruptly down with the decrease of the particles' energy. This means that CNF is not only possible but must occur and does so in suitable physical systems of very different types. A direct experimental confirmation of these theoretical predictions is the recent measurements of sections of D-D reactions in the 20-400 eV deuteron energy regions, which turned out to be 10^{10} times higher than follows from quantum mechanics [R.J. Beuhler, 1989].

It follows from UQT, that certain local phase correlations are prerequisite for a CNF reaction in an operational environment. Analysis of experiments so far made in CNF produces an impression that the reaction is effective only in cases of at least weak phasing, determined by either the inner structure of the environment or applied variable external fields. The theoretical analysis of deuteron's interaction dynamics shows that tritium and helium would be predominant over neutrons in reaction products; that also corresponds to the experimental facts. The mechanism of the phenomenon resembles the Oppenheimer-Phillip's effect. The existence of CNF phenomenon and its natural explanation in UQT, that had been stated well before the epoch-making M.Fleischmann and S.Pons experiments, give us ground to believe that a successful CNF reactor could be designed and constructed.

3. Main trends for research and working plan

In order to design a CNF reactor founded on UQT, it is essential to solve the fundamental issue whether the probability of the "tunnel effect" depends on the phase of the wave function. Proceeding from this point, the first stage of research should involve the effect's experimental confirmation. If the existence of this effect is not reaffirmed it will be necessary to look for another explanation of the CNF phenomenon .

The experimental discovery of the "tunnel effect" dependence upon the wave function phase would prove the validity of UQT and of the selected principles for construction of CNF reactors. According to current views, CNF is only possible in an environment possessing certain physico-chemical properties. These may be substances either of solid or liquid phase. For instance, it may be deuterium-based organic combinations synthesized with the help of superpure technologies. There are no principal difficulties in producing such substances nowadays.

A great amount of fundamental research is to be carried out into the energy production mechanisms resulting from the process of cavitation bubbles' formation and "bursting" in liquid. The results obtained to date

New Energy Times Archive

are very promising. The same mechanisms could be extremely useful in biological purification of sewage waters. Besides, UQT opens up a new way for electron current control in semiconductor tunnel devices. The essence of it is that the controlled value is a wave function phase, the electron potential barrier penetration coefficient in the tunnel effect being dependent on the latter. This would allow the creation of new semiconductor devices of still higher speed. Proceeding from the information stated above, we propose the following theoretical and experimental research plan:

Stage 1.

1. Mathematical analysis of UQT equations: correct problem statement, existence and singularity of the solution, etc. Development of approximate and qualitative methods of equation analysis. Development of numerical solution methods of systems of UQT equations and software. Development of methods and forms of representation and interpretation of numerical experiment results.

2. Building mathematical models of deuterons' and other particles' interaction. Solving of inverse problems for selection of potentials corresponding to experimental data. Defining conditions for, and estimating the effectiveness of particles' interaction in environments with various structures under the impact of various external fields.

3. Development, on the basis of theoretical results obtained, of experimental technique proving the dependence of nuclear reaction course on the wave function phase.

4. Theoretical and experimental research (up to building of a working reactor model) into the cavitation processes in bubbles of liquid responsible for the new energy production mechanisms.

5. Theoretical and experimental research associated with the problem of purifying sewage waters.

6. Theoretical and experimental work in the field of fabrication new high-speed electronic devices.

7. Selection of staff personnel and the experimental base. Working out a concrete plan for experimentation with cost estimates.

The experimentation could be carried out in Dubna, Novosibirsk, or Tomsk (Russia) using the available experimental equipment, which won't require any additional investment.

Completion time: 1-2 years. Wages for the main staff: US $ 500,000 a year.

The equipment required for theoretical research: a personal computer for each worker; a workstation for analytical calculations with corresponding software; the ability to use a supercomputer. It should be noted, that in the event that the equipment of the above-mentioned type is already available in the research center, no additional investment would be required.

Stage 2.

1. Direct experiments in impacts of a wave function phase on a "tunnel effect" probability for electrons, protons and light nuclei.
2. Experiments producing D-D, D-Li, D-T reaction cross-section estimates in a small energy region.
3. Specification of UQT mathematical models on the basis of experimental data. Considering the possibility of further work aimed at CNF reactor construction based on UQT.

Completion time: 1-2 years. Wages for the main staff: US $ 500,000 a year. Estimated cost of experimental work: US $ 1,000,000 a year.

Work on stage 1 and 2 may be carried out partially simultaneously, which will shorten overall fulfillment time. If the experimental results turn out to be negative, further work should be changed accordingly.

The overall completion time for stages 1 and 2 may amount to 2.5 - 3.5 years with total wages and experimentation cost on the order of US $ 5,000,000.

The next stages of work are aimed directly at building CNF reactor demonstration models.

Stage 3.

1. Formulation of requirements for CNF reactor operational environment parameters, their production methods, and techniques.
2. Development of proposals for designing of laboratory installations, selection of reacting systems and the structure of the operational environment and external fields.
3. Designing of alternative basic CNF reactor models on the basis of comparing theoretical technico-economical data for different environments. Development of engineering techniques for calculation and designing of reactor laboratory models.
4. Building of laboratory models of CNF reactors.
5. Carrying out of patent work. Formulation and patenting of the basic principles for CNF reactors.

Completion time: 2-3 years. Wages for the main staff: US $ 500,000 a year. Estimated cost of experimental work: US $ 2,000,000 a year.

Stage 4.

1. Selection of the best CNF reactor system by comparing technico-economical specifications of alternative laboratory models.
2. Development of engineering techniques for designing production models.
3. Building of an experimental (demonstration) model of a CNF reactor.
4. Estimation of experimental model's efficiency and competitiveness. Selection of ways to improve the technico-economical specification. Resolving of problems connected with development of mass production infrastructure for CNF reactors.
5. Carrying out of patent work. Patenting of reactor design and required technical solution.

Completion time: 2-3 years. Wages for the main staff: US $ 500,000 a year. Estimated cost of experimental work: US $ 5,000,000 a year

The overall cost estimate of stages 3 and 4 which can take 5 or 6 years to complete ranges from US $ 5,000,000 to 6,000,000 a year (the total sum amounting to US $ 20,000,000 - 30,000,000). More exact figures could be given only after successful completion of stages 1 and 2.

The above-stated research should be carried out in the investor country. The main research group is expected to consist of 6-8 people. The estimated cost of experimentation provides that experiments should be carried out in Russia. The same research would cost 10 to 20 times more in the West.

4. Further perspectives

Development of UQT may serve as a

New Energy Times Archive

foundation for solving the following scientific and technical problems:

1. Experimental confirmation of UQT assumptions will allow a new and fuller description of quantum phenomena. It is possible that UQT will start a new era in development of fundamental knowledge about Nature.
2. UQT can help in resolving global energy problems on the basis of building pollution-free low-power reactors, using the CNF mechanism. The cost of experimentation and reactor design will be incomparably less than of classical research in the field of thermonuclear fusion and fission reactors. There are grounds to believe that the commercial properties of CNF reactors will be extremely attractive.
3. Apart from heat output, such reactors can produce tritium, isotopes of other elements, and, possibly, plutonium. This could find application in medical and in military areas. Therefore, the rational utilization of reactor by-products will also promote their successful commercialization.

It is now hard to imagine all the prospective fields in which UQT might be used. The research on these possibilities could involve almost every sphere of human activity. Doubtless, the use of CNF phenomenon in the field of small energy sources will contribute to the harmonious development of mankind according to the laws of Nature and Life.

Scientific leader of the project:
Professor, Dr.Sc.,Ph.D., Lev G.Sapogin
Head of Physics Department
MADI Technical University
Moscow, Russia

Administrative director of the project:
Cosmonaut Vladimir A.Dzhanibekov
Major-General Air Force, RF

Assistant in science:
Professor, Dr.Sc.,Ph.D., Vladlen S.Barashenkov, Head of Sector, Joint Institute for Nuclear Research,Dubna
Moscow region, Russia

Assistant in experimental work:
Professor, Dr.Sc.,Ph.D., Vladimir P.Nikitsky, Director of the ENERGY Scientific Production Association
Podlypky, Moscow region, Russia

EXPERIMENTER'S CORNER

PROTOCOL FOR CONTROLLED AND RAPID LOADING/UNLOADING OF H_2/ D_2 GAS IN SELF HEATED Pd WIRE TO TRIGGER NUCLEAR EVENTS

A. B. Garg, R.K. Rout, M. Srinivasan
A. Shyam and L. V. *Kulkarni*
Neutron Physics Division
Bhabha Atomic Research Centre
Trombay, Bombay 400 085, India

Dr. M. Srinivasan, Bhabha Atomic Research Center—gave cold fusion papers at ICCF5, including this remarkable experiment that you can try yourself.
Photo: EFM

OBJECTIVE OF EXPERIMENT

It has now been established that during electrolysis of LiOD using Pd cathodes, a threshold loading ratio of at least 0.85 needs to be achieved before excess heat production can be expected. However for neutrons and tritium (and possibly charged particles and transmutation products too) much lower D/Pd ratios, in the region of 0.4 to 0.7 appears to be adequate . This has independently been corroborated in a variety of gas loading experiments. It is not so much the magnitudes of the steady state loading ratio, but rather creation of non - equilibrium conditions which facilitates rapid migration/transport of deuterons within the Pd lattice that seems to be required.

With this in view, a systematic study has been undertaken using electrically self- heated 0.125 mm dia Pd wires in H_2/D_2 atmospheres to optimize the conditions under which rapid loading/unloading of H_2 or D_2 can be achieved. Pd wire was obtained from Leico Industries,USA. The purity of wire is 99.9%.

PRETREATMENT FOR FAST LOADING

After a number of trial experiments the following protocol was established for optimum and rapid loading.

1. Measure initial wire resistance (R_o* of unannealed wire).
2. Heat wire to glow hot condition in air by ohmic heating. (R_t/R_o, i.e Ratio between resistance at glow hot condition to resistance at room temperature is approximately 3).

3. Lower the current (< 100mA) and measure resistance. (after wire cools down) in atmospheric air; this is R_o value to be used for further study. This may differ slightly from R_o*.

4. Evacuate system and heat wire to red hot condition. (Current for red hot condition in vacuum is much lesser)

5. Introduce air under red hot condition. (this provides a thin oxide layer on wire surface)

6. Evacuate once again.

7. Introduce H_2 or D_2 as required under red hot condition.

(It reacts with oxide layer and activates surface) Measure resistance (R_{max}) after cooling.

8. A loading of approximately 0.6 (R_{max}/R_o~ 1.7 for H_2 and 1.85 for D_2) is achieved within 2-3 minutes, provided activation is done properly. Loading increases further to ~0.7 in another 30 minutes.

Note: For rapid loading, the wire should be as hot as possible during step No.7. But increasing wire temperature unduly has the risk of accidentally burning out the wire.

SUMMARY OF TYPICAL PARAMETERS

Wire diameter mm	0.125
Wire length mm	~100
Annealed wire resistance R_o ohms	0.8

New Energy Times Archive

Resistance at red hot condition R_t 2.5 ohms
Vacuum required in chamber $>10^{-2}$ mb

(Presence of small amount of air in the chamber may be beneficial for activating surface).

H_2/D_2 gas filling pressures 1-2 Atmospheres

R_{max}/R_o is found to reach close to peak of resistance ratio curve.(See Fig.1)

HYSTERESIS STUDIES

To get the hysteresis curve following procedure is adopted.

1. Load the wire at particular gas pressure to the maximum extent possible. (0.7 in our case)

2. Slowly increase the current in steps. Measure the resistance at each current value after wire temperature stabilizes. (resistance goes up because of ohmic heating)

3. At some value of current, resistance suddenly drops.

4. On increasing current further, at a particular current, wire resistance starts going up again. (In this state wire is fully unloaded)

5. To obtain hysteresis curve now slowly decrease the current; resistance starts decreasing; at some value of current resistance starts increasing (wire begins to load) but the current at which it starts loading in reverse cycle is less than in the forward half cycle.

6. Some hysteresis curves obtained by us are shown in Fig .4 .

PROCEDURE FOR REPEATED CYCLES OF LOADING and UNLOADING

From the hysteresis curves corresponding to a given filling pressure, select the lower and upper safe current values at which absorption and desorption will be rapid and assured. For the case of D_2 gas at 2.1 atm for example (see Fig.4) the lower and upper current could be 0.9 and 1.7 Amps for loading and unloading respectively. One can make a simple automatic switching which will flip the current between these two values by shorting across a precalculated resistance which is placed in series with Pd wire. Since loading takes a longer time, it is recommended to spend more time in absorption mode than in desorption.

VERIFICATION OF (H(D)/Pd) LOADING RATIO.

On routine basis Resistance Ratio is used to infer the degree of loading. However to cross check the loading value, (a) Inert gas fusion technique and (b) Oil manometer techniques were used in few cases. All the three techniques were found to give comparable loading values.

APPLICATIONS

Having learnt to absorb/desorb H or D in a 100% reproducible and controlled manner in Pd wire creating nonequilibrium conditions following experiments are under way in search of anomalous nuclear effects.

1. Autonradiography: After loading the wire with H_2 or D_2 it was autoradiographed on x ray film.

- ***Every loaded wire has shown fogging of x -ray film.***
- ***Even a low loading of 0.1 has fogged the film.***
- ***This is the phenomena of PdH luminescence reported by our group first in 1992.***
- *Efforts to understand the cause for fogging are under investigation.*

2. Charged particles detection Solid State Nuclear Track Detector (SSNTD) and Surface barrier detector were used to detect emission of charged particles if any. So far we have not succeeded in getting any charged particle signal. 3 Tritium measurement and neutron detection experiment are under way.

SUMMARY OF MAIN RESULTS

1. We are able to load up to a H(D)/Pd value of 0.7 both in case of H_2 as well as D_2.

2. We do not find any difference in loading rate whether it is D_2 or H_2.

3. Loading is fast if the gas (H_2 or D_2) is introduced in the system when the wire is red hot. Because of good conductivity of hydrogen wire temperature automatically falls below the threshold temperature absorption in Pd.

4. Since temperature at which wire gets unloaded is less in D_2 (65°C) than in H_2 (95°C), for a given pressure current for deloading is lower for D_2 than for H_2. (see Fig.2)

5. Loading rate does not depend very much upon H_2 or D_2 gas pressure (at least in region of few tens of mb to 4 bars, which we have studied), but it is very sensitive to the pretreatment given to the wire.

6. Rate of unloading, of a loaded Pd wire at room temperature in atmospheric air surprisingly found to be quite slow. (see Fig.3)

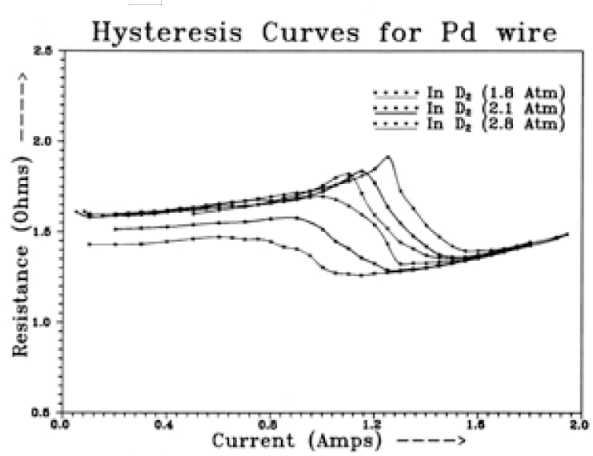
7. If the wire surface is activated properly loading up to 0.6 or 0.7 can be attained with 100% reproducibility.

Other BARC papers presented in poster form at ICCF5:

1. Evidence for tritium generation in self-heated nickel wires subjected to hydrogen gas absorption/desorption cycle. (Chemical Engineering Division—Sankaranarayanan et al)

2. Observation of high-multiplicity bursts of neutrons during electrolysis of heavy water with Pd cathode using the dead time filtering technique. (Neutron Physics Division—Anurag Shyam et al)

3. Preliminary results of the variation of electrical resistance of a TiD wire with deuterium concentration (Technical Physics Division—V.K. Shrikhande et al)



New Energy Times Archive

BRIEFS

Cold Fusion continues to be active in Italy, as evidenced by the Workshop held shortly before ICCF5:

IV Workshop on the Status of Cold Fusion in Italy

Organized by Rome III and Siena Universities March 24-25 '95 - Siena

SCIENTIFIC PROGRAM

Friday 24 - Aula Magna Universita' di Siena
18:00 Welcome by the Dean of Siena University.
19:00 B. Stella (Roma 3): Introduction

Review of recent related conferences:

19.15: *V. A. Tsarev (Lebedev Instit., Moscow):* Review of the Second Russian Conference on Cold Fusion and Nuclear Transmutation (Soci, Sept. '94).

20.30: Banquet (sponsored).

Saturday 25 - Facolta' di Ingegneria- Porta Romana (Siena)

9:00: Visit to the Siena experiment (running) .

Saturday 25 - Certosa de Pontignano (Siena)

10.15: Chairman *F. Scaramuzzi (ENEA and CNR-Frascati)*

C. Sanchez Lopez (Madrid Univ.): Hydrogen in metals: summary of the conference in Japan (Nov. '94).

New results

S. Focardi (Bologna): The Siena experiment: heat excess, gamma rays.
F. Piantelli (Siena): Reproducible hydrogen loading of nickel and evidence for heat production and nuclear effects.

12.15: Coffee break.

12.30: Chairman *T. Bressani (Torino)*
S. Veronesi (Siena): Gamma rays and neutron activation in the Siena experiment.
Ch. E Stremmenos (Bologna): Reproduction of nickel loading by hydrogen.

Discussion of the experiment by F. Piantelli, S. Focardi, R. Habel and co-workers.

13:15: Lunch.

Saturday 25 - Certosa di Pontignano (Siena)

14.30: Chairman *F. Piantelli (Siena)*

T. Bressani (Torino): Search of ^{4}He from a Pd-D system in gas phase (a la Coehn).
F. Celani (INFN-Frascati): Evidence for a possible phase transition under deuterium overloaded conditions of palladium wires and related excess heat phenomena.

V. A. Tsarev (Moscow): Current instability effects in experiments with overloaded hydrides.

V. Violante (ENEA-Frascati): Status of the Frascati-Bologna experiment.

M. Fabrizio (Padova): Experiences with electrochemical loading of gold plated Pd.

B. Stella (Roma 3 and INFN Roma 1): Detection of protons and light nuclei with FERMI apparatus and a cryogenic loading up to H/Pd=1.33.

17.00: Coffee break

17:20: **Models and Theories**
Chairman *B. Stella (Roma 3)*
W. J. K F. Collis (PCS Ltd., Boglietto(Asti)): A neutral view of cold fusion. Poli-neutrons?

E. Del Giudice (Milano): Reassessing a theoretical controversy.

V. A. Tsarev (Moscow): Initiation of nuclear fusion reactions by means of selective heating of condensed matter. On a possibility to increase the rate of nuclear reactions initiated by reversal polarization of deuterated ferroelectrics.

18.30: General discussion.

F. Piantelli (Siena): Close of the workshop.

POSTER SESSION
L. Daddi (Livorno): Review of cold fusion phenomenology.

The proceedings (in English) will be printed in about one month and might be ordered (at the cost of 60 dollars, postage included) to the editor (Prof. B. Stella, Rome III University Dipartimento di Fisica Univ. "La Sapienza"- P. A. Moro 2-00185 Roma; E-mail: stella@romal.infn.it)

FIRST CALL

1996 INTERNATIONAL WORLD ENERGY SYSTEM CONFERENCE JUNE 19, 20, 21 TORONTO-CANADA

THE WORLD ENERGY SYSTEM: THE TRANSITION FROM LOCAL, NATIONAL, REGIONAL, TO GLOBAL ENERGY PHILOSOPHY

Energy is an important issue worldwide. Today, the energy system is a globally interconnected entity. Energy information, energy technology, and energy resources require a comprehensive, system of world wide management. The conference promotes a new con cept of sustainable energy development in a systemic, dynamic, probabilistic and global perspective. It will stimulate discussions on these challenging issues.

The aim of the conference is to define the requirements and evolution in new key areas of world energy system

THEMES: Global and long term views on energy resources: gas, oil, coal, nuclear, solar. Infra structure: generation and distribution of electricity, district heating and cogeneration, conservation and efficient use of energy. Environment and energ y: the four "E's": economics, energy, entropy, ecology. New developments in the energy and economic markets (CEE, NAFTA, APEC). New technologies in the field of energy. Forecast on the future development of reliability criteria of energy systems. Models of energy systems. Management of energy systems: liberalization, privatisation, information, vertical integration. World energy system: dream or reality

SPONSORS: Faculty of Engineering and Applied Science, Ryerson Polytechnical University, Toronto, Ontario, Canada; Canadian Institute World Energy System, Toronto, Ontario, Canada

DATES: Participation notice: June 30, 1995. Date to submit papers: December 31, 1995. Registration of participants: June 18, 1996. Conference: June 19, 20, 21, 1996

ABSTRACT: A 1-page, 50 words

New Energy Times Archive

abstract including: paper title, name, affiliation, mailing address, phone & fax numbers, e-mail. A 2-page summary that states clearly & concisely the specific results of your previously unpublished work, why the results are important , and how the results relate to prior work. Article: The body of the article should be typed in two columns with single line spacing in English or French.

PROCEEDINGS: Conference proceedings will include the keynote addresses, the contribut ed papers, resolutions and discussions. The proceedings will be available on December 1, 1996, at a price of US $150 per copy.

REGISTRATION: Conference registration: US $350 payed by May 30, 1996, with cheque or money order payable to Canadian Institute World Energy System, 5 Strathgowan Crescent, Toronto, Ontario, M4N 2Z6, Canada, Tel: (416) 487-0479, Fax: (416) 489-4413, E-Mail: WES@ acs.ryerson.ca

CONFERENCE LANGUAGE: English.

There usually isn't much to laugh about on the Internet discussions of "cold fusion"— except when a top comedy team decides to get into the act....

Newsgroups: sci.physics.fusion
Subject: Cold Fusion: The Musical
Date: 17 May 1995 16:32:47 GMT
Organization: Edmonton Freenet, Edmonton, Alberta, Canada

Press Release—for immediate release
Three Dead Trolls in a Baggie and Atomic Improv team up to bring the world:

Cold Fusion: the Musical!

May 15, 1995

Comedy titans Three Dead Trolls in a Baggie and living legends, Atomic Improv, have joined forces to bring you Cold Fusion the Musical. Cold Fusion the Musical chronicles the biggest scientific controversy of our century. In 1989 Doctors Stanley Pons and Martin Fleischmann announced to the world that they had discovered a cheap, clean, and nearly limitless supply of energy — cold fusion. Had they? Or had they made a monumental mistake? The agony! The ecstasy! The electrochemistry! If Arthur C. Clarke had written for *Mad Magazine*, it might have been something like this. The show will be running every night except Monday at eight o'clock starting June 1st at the Chinook Theatre. Three Dead Trolls will also be booking private shows, so school groups or other interested parties should call. (403) 497 0418 for more information.

U.S. Patent Office Awards Second Cold Fusion Patent— Assigned to MIT! MIT Professor Keith H. Johnson is Co-Inventor

The first page of the patent:

United States Patent
Ahern et al

Patent Number: 5,411,654
Date of Patent: May 2, 1995

Method of Maximizing Anharmonic Oscillations in Deuterated Alloys

Inventors: Brian S. Ahern, Boxboro; Keith H. Johnson, Cambridge; Harry R. Clark, Jr., Townsend, all of Mass.

Assignee: Massachusetts Institute of Technology, Cambridge, Mass.

Appl. No.: 86, 821

Filed: July 2, 1993

Int. Cl.6.....C25B 9/00; C25B 11/08
C25C 7/00; C25C 7/02
U.S. Cl.....204/242; 204/292;
204/293; 204/290R
Field of Search.....156/656;204/129.1, 204/129.55, 140, 129.35, 224 M, 129.43, DIG. 9, 129.35, 129.7, 242, 292, 293, 290 R

References Cited

U.S. Patent Documents

3,219,481 11/1965 Chodosh et al.....204/140 X
3,620,844 11/1971 Wicke et al.....429/44
4,222,900 9/1980 Bohl.....156/656X
4,284,482 8/1981 Yahalom.....204/140
4,925,535 5/1990 Matsumoto et al..204/140 X
5,078,834 1/1992 Witte.....156/656

OTHER PUBLICATIONS

Clerjaud and Gelineau, "Strong spin-lattice coupling of kramers doublets," Phys. Rev. B, vol.16, No.1, July 1977, 82-85.
Singh et al., "Effect of anharmonicity on superconducting metal-hydrogen systems," Phys. Rev. B, vol.18, No.7, Oct. 1978, 3271-74.
Huberman et al., "Chaotic States of Anharmonic Systems in Periodic Fields," Phys. Rev. Let., vol.43, No.23, Dec. 1979 1743-47.
Kohara et al., "NMR Study of Size Effects in....," Jnl. Phys. Soc. Jap., vol.54, No.4, Apr.1985, 1537-1542.
Hamann et al.,"Anharmonic vibrational modes of chemisorbed H...," Phys. Rev. B, vol.37, No.8, Mar.1988, 3847-3855.
Hemmes et al., "Isotope effects and pressure dep..., " Phys. Rev.B.. vol.39, No.7, Mar.1989, 4110-4118.
Fleischmann et al., "Electrochemically induced nuclear fusion...," J. Electroanalytical Chem., 261, Mar. 1989, 301-308.
Jones et al., "Observation of cold nuclear fusion...,"Nature, vol.338, Apr. 1989, 737-740.
Yokoyama et al., "Temperature-dependent EXAFS Study...." Jap. J. Appl. Phys., vol.28, No.9, Apr. 1989, L851-L853.
Yokoyama et al., "Temperature dependent EXAFS Study...," Physics B, 158, no month 1989, 255-256.
(List continued on next page)

Primary Examiner—Donald R. Valentine
Attorney, Agent, or Firm— Theresa A. Lober

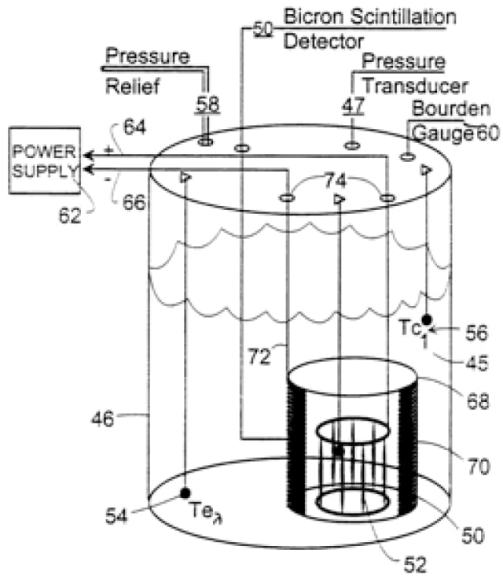
Abstract

For a condensed matter system containing a guest interstitial species such as hydrogen or its isotopes dissolved in the condensed matter host lattice, the invention provides tuning of the molecular orbital degeneracy of the host lattice to enhance the anharmonicity of the dissolved guest sublattice to achieve a large anharmonic displacement amplitude and a correspondingly small distance of closest approach of the guest nuclei. The tuned electron molecular orbital topology of the host lattice creates an energy state giving rise to degenerate sublattice orbitals related to the second nearest neighbors of the guest bonding orbitals. Thus, it is the nuclei of the guest sublattice that are set in anharmonic motion as a result of the orbital topology. This promotion of second nearest neighbor bonding between sublattice nuclei leads to enhanced interaction between nuclei of the sublattice. In the invention, a method for producing dynamic anharmonic oscillations of a condensed matter guest species dissolved ina condensed matter host lattice is provided. Host lattice surfaces are treated to provide surface features on at

New Energy Times Archive

least a portion of the host lattice surfaces; the features have a radius of curvature less than 0.5 microns. Upon dissolution of the guest species in the treated host lattice in a ratio of at least 0.5, the guest species undergoes the dynamic anharmonic oscillations.

16 Claims, 12 Drawing Sheets



Washington Watch

This letter is reprinted, courtesy of Space Energy Journal *(June, 1995) of the Space Energy Association, PO Box 11422, Clearwater, FL 34616*

To: Meg Greenfield
Editor, *Washington Post*
March 21, 1995

Twenty years ago I was Special Consultant to the U.S. House Interior Committee's Subcommittee on Energy and the Environment. I was also an energy speechwriter and hearing coordinator for Morris Udall, then subcommittee chairman and a presidential candidate. But in the two decades since the energy crisis erupted and then disappeared, worldwide oil consumption has more than *tripled* and electricity production has *doubled*. These greedy ways may have moved us into the millennial apocalypse predicted by the prophets.

I therefore read with great interest the lucid and sobering articles *Global Plague?* by Paul Epstein and Ross Gelbspan and *Signals from Earth* by Jessica Mathews in *Outlook*, March 19. Even the possibility that our overburning of fossil fuels may have heated Earth's environment sufficiently to trigger plagues and other disasters demands our most serious immediate attention.

Competent mainstream climatologists and disease control experts give us strong evidence that we humans may be the ones who are causing the global warming which created the current persistent El Nino condition and subsequent weather extremes that are breeding our potential extinction. What we need are radical solutions, ones that transcend the weak and incremental emission controls now being considered at the Global Climate Treaty conference in Berlin.

I propose one such solution: developing the overlooked "zero-point" energy which is awesomely abundant and appears to be clean if used appropriately. Hundreds of competent researchers have demonstrated this new form of energy in the laboratory, and [it] is predicted by quantum theory. Examples probably include cold fusion, Faraday disk magnetic motors, solid state devices, and various Tesla systems. These technologies have been actively suppressed but are coming out of the closet rapidly—particularly in Japan.

As part of the research for my forthcoming book *Miracle in the Void*, I have travelled the world, visiting the labs of scientists, engineers, and inventors who have convincingly shown me the production of this "free energy" in the form of electricity. But we are still at the "R" of the R&D cycle.

The ecological mandate now so eloquently articulated by Epstein and Gelbspan strongly suggests we may soon need to be ready to make the needed radical displacements from an oil/coal/wood economy to a clean energy economy-if it isn't too late already.

The rapid development of new energy sources requires us to come together now as a tiger team of innovators. So far, these talented practitioners have been isolated, underfunded, ridiculed, and sometimes threatened, expatriated, or bought out. It is a sad story of suppression.

The time is now for us to set up, Apollo- and Manhattan [Project]- style, a new research-and-development laboratory to bring together the needed technologies. About $100 million per year should be sufficient. "Apocalypse does not point to a fiery Armageddon," said the late Joseph Campbell about our times, "but to the fact that our ignorance and complacence are coming to an end."

Brian O'Leary, Ph.D.
Former NASA Scientist-Astronaut

Excerpts from an ariticle in Science, Vol.268 12 May 1995, p.794

"O'Leary Takes Swipe at Bureaucracy

Surrounded by huge charts and graphs, Energy Secretary Hazel O'Leary last week promised to cut more than $14 billion over the next 5 years from the Department of Energy's (DOE's) budget without jettisoning any research programs. O'Leary and a team of DOE officials want to slash the number of employees and sell off everything from DOE's power-marketing administrations to gold and highly enriched uranium. Almost 4000 jobs will be eliminated. In contrast, O'Leary singled out science and technology as favored missions: "We're cutting out the crap so we can do this work," she told reporters at a press briefing. The result will be a "dramatically different and rationalized DOE."
.....
"But while the plan seems the epitome of fiscal austerity, congressional staffers and Energy Department officials say it will not relieve pressure to drop one or more of several proposed research facilities, including the National Ignition Facility at Livermore or the Tokamak Physics Experiment at Princeton University that are central to the U.S. fusion effort. The President's Committee of Advisors on Science and Technology hopes to complete a report this summer outlining fusion's future." —Andrew Lawler

[Caption under O'Leary photo: Chop Shop. O'Leary would "cut out the crap" to save science.]

From *The Wall Street Journal*, June 14, 1995, p.B5

"Washington— A House Appropriations subcommittee approved deep cuts from solar energy and fusion programs, while preserving funding elsewhere for mroe basic science research in the Energy Department.

"Solar and renewable energy funding would be cut almost in half to $201.6 million for the new fiscal year beginning October 1, And the $229 million budgeted for fusion research represents a 38% cut from the current levels and severely threatens the Tokamak Physics Experiment at Princeton University."

New Energy Times Archive

For an Excellent Overview and Introduction to Cold Fusion and New Energy Technology.....

ORDER THE VIDEO TAPE SET OF MIT COLD FUSION DAY- January 21, 1995

at the Massachusetts Institute of Technology

Four (4) two-hour VHS video tapes—8 hours total viewing— are available as a set, or individually. These were only slightly edited from professionally taken video footage of the day-long Cold Fusion session at MIT on January 21, 1995. The tapes include the following material:

TAPE#1

Dr. Eugene F. Mallove
(Cold Fusion Technology, Concord, NH)
"Cold Fusion and New Energy Technology - An Overview"

Dr. Peter Graneau
(Northeastern University Center for Electromagnetic Research)
"Anomalous Forces in Water Plasma Explosions"

TAPE#2

Buford ("Ray") Conley
(MIT, graduate student, Dept. of Aero/Astro Eng.)
"Light Water Excess Heat Experiments"

Fred Jaeger
(ENECO, Salt Lake City)
"Patents and Commercialization"

Professor Peter L. Hagelstein
(MIT Dept. of Electrical Engineering and Computer Science)
"Cold Fusion: What We Know and What We Don't Know"

TAPE#3

Professor Peter Hagelstein
(CONTINUED from TAPE #2)
"Cold Fusion: What We Know and What We Don't Know"

Professor Keith Johnson
(MIT Dept. of Materials Science and Engineering)
"Progress in the Theory of Excess Heat" *and Excess Heat*- The Movie, now being made by Hollywood!

James L. Griggs
(Hydro Dynamics, Inc., Rome, Georgia, USA)
"The Hydrosonic Pump: Excess Power and Other Effects"

TAPE#4

Bertil Werjefelt
(PolyTech(USA), Hawaii)
"Energy from Magnetic Materials and Magnetic Fields"

Dr. Eugene F. Mallove
(Cold Fusion Technology, Concord, NH)
Concluding Remarks

The tapes include the speakers' presentations as well as question and answer sessions. There is footage of the Hydrosonic Pump under test as well as close-up footage of rotor surface melting effects. Bertil Werjefelt shows footage of experiments in his own laboratory. There are scenes of Japanese researchers from Sumitomo, Hitachi, and other companies and universities now involved in their claimed extraction of energy from magnetic materials. These efforts are now said by these researchers to be proceeding toward commercialization. Actual experiments are seen in progress. The tapes are VHS cassettes in NTSC format and range from 120 to 127 minutes each.

To order **the full set of four, two-hour tapes**, please send check or money order to Cold Fusion Technology for **$79.95 plus $5.00 shipping and packing, within U.S. and Canada.** [For other foreign orders, please replace the $5.00 shipping fee with $30.00 for air shipment.] To order *individual tapes*, please specify which tape(s). Please send check or money order for $25.00/tape, plus $3.00 shipping and packing if only one tape, or $5.00 total if more than one tape.

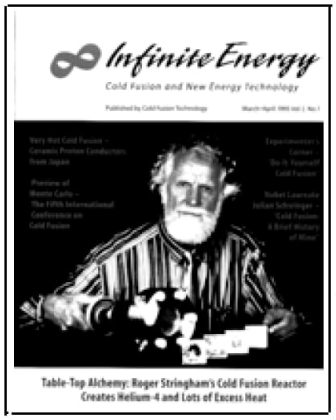
Tapes are Copyright 1995, Cold Fusion Technology.
Please send payments to:

Cold Fusion Technology
P.O. Box 2816
Concord, NH 03302-2816
Fax: 603-224-5975 Phone: 603-228-4516
E-Mail: INTERNET:76570.2270@compuserve.com

New Energy Times Archive

Join the Cold Fusion and New Energy Revolution....

Subscribe to the leading publication



Infinite Energy

Cold Fusion and New Energy Technology

INFINITE ENERGY premiered with the March/April 1995 issue. Order your subscription now, beginning with either the premier issue or a subsequent issue.

INFINITE ENERGY is an international technical magazine with outreach to the general public as well. To maintain the highest editorial standards, it is written and edited by scientists, engineers, and expert journalists. It is aimed at pioneering scientists, engineers, industrialists, and investors who are entering an exciting new R&D area. This continues to grow explosively, with significant involvement by Japanese corporations and an increasing number of U.S. companies. New technology developments and scientific discoveries are being made monthly and reported in the peer-reviewed scientific literature. ***INFINITE ENERGY*** reports on the latest information that is now pouring in from research centers around the globe.

The affordable subscription price of this six-issues/year publication of general *and* technical interest is $29.95 for residents of the U.S. and Canada. (To cover first-class air mail for other countries, the annual foreign subscription price is $49.95.)

To subscribe to *INFINITE ENERGY* in 1995, beginning with (Check one: ___ the March/April premier issue or the ____/____ issue, please enclose check or money order to Cold Fusion Technology, or enter Credit Card information:

Name: _____

Address: _____

Address: _____

City: _____ State: _____ Postal Code/Zip: _____

Country: _____ Phone: _____ Fax: _____

If using Credit Card: Check one: Master Card __ VISA __ American Express__

Card Number: _____ Expir. Date: _____

Signature _____ **Optional:** E-Mail address _____

Cold Fusion Technology

P.O. Box 2816 Concord, NH 03302-2816 USA

Fax: 603-224-5975; Phone: 603-228-4516

E-mail:INTERNET:76570.2270@compuserve.com

New Energy Times Archive